

THE HIGHLANDS
OF
SOUTH-WEST SURREY



E·C·MATTHEWS

STUDIES IN ECONOMICS AND POLITICAL SCIENCE

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THE HIGHLANDS OF SOUTH-WEST SURREY

UNIFORM WITH THIS VOLUME

THE REIGATE SHEET
OF THE
ONE-INCH ORDNANCE SURVEY

A STUDY IN THE GEOGRAPHY
OF THE SURREY HILLS

BY

ELLEN SMITH

*Head of the Geography Department in the Skinners' Company's
School for Girls, London*

“Miss Smith has put together an excellent little text-book which should form a most suggestive introduction to the geography of the neighbourhood.”—*Spectator*.

A. AND C. BLACK, SOHO SQUARE, LONDON, W.

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THE HIGHLANDS OF SOUTH-WEST SURREY

A GEOGRAPHICAL STUDY IN
SAND AND CLAY

BY

E. C. MATTHEWS

ERRATUM

Page 51, under "Books," for last paragraph substitute the following :

"The Relations of the River Wey to the Blackwater and the Arun," by Bury. The South-Eastern Naturalist ; Transactions of the S. E. Union of Scientific Societies, 1910, p. 14.

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The shaded section represents the portions of the sheets comprised in the monograph.

NOTE

THE tract of country hereafter described lies in the south-west of Surrey, and takes in the adjoining portions of Hampshire and Sussex. The monograph is the result of personal observation, and every part of the country described in it has been walked over.

As a region it has been studied from the point of view of vegetation, which has involved some study of the structure, conditions of soil-formation, climatic considerations, and the degree in which these have influenced settlement and industries.

As regards the vegetation, all that is written here holds good of this particular region. Under different conditions, plants or trees here limited to a special district may vary in their choice of soil or locality.

The maps, with one exception, are based upon the maps of the Ordnance Survey. In the Orographical Map, only those contours are selected which best seem to give the true character of the relief. These are the contours of below 200, 200-300, 300-500, 500-700, and above 700 feet.

In a separate map of the highest part of the region each contour of 100 feet is shown.

The small map of the Domesday Survey of South-West Surrey is an enlarged portion of the Domesday Map given in "The Victoria History of Surrey."

Much kindly help and friendly advice has gone to the making of this monograph. I would, however, specially thank, first Mr. Sargent, to whom fell the arduous task of reading the monograph in manuscript, and to whose teaching I owe much; also Professor Lyde for his kind help in revision of the sheets for the press, and for his useful suggestions. I also owe very grateful thanks to Dr. H. R. Mill and to Mr. Swanton, of Haslemere, who, from their special knowledge, gave me valuable help and criticism, and made many kind suggestions, of which I gladly availed myself.

I am also indebted to Messrs. West and Sons, of Godalming, for their kindness in allowing the reproduction of the photographs which bear their name.

E. C. MATTHEWS.

DURHAM HOUSE,

DARTMOUTH PARK HILL, N.W.,

June, 1911.

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facing page 118.*

“This county of Surrey presents to the eye of the traveller a greater contrast than any other county in England. It has some of the very best and some of the very worst lands, not only in England, but in the world.”—WILLIAM COBBETT.



Photo, Hest & Son, Godalming.

Looking towards Witley from Hindhead.

THE HIGHLANDS OF SOUTH-WEST SURREY

I

The characteristics of South-West Surrey—The central block—The outlook from Hindhead—The outlook from Blackdown—Geological structure—The contrast of sand and clay—The cutting of valleys—The Devil's Punch Bowl—On the road to Farnham—Hindhead and Blackdown contrasted—The descent to the Weald—Lanes in the sandstone.

It was a very natural feeling, truly, though blindly geographical, that gave rise to a belief in the presence of active forces of kindly or malicious spirits dwelling in hill and stream and rock, which exercised a subtle influence upon the human beings at the mercy of their incomprehensible energies, and whose influence was felt wherever man and Nature came in contact.

The modern geographer, no less than the simple folk of earlier times, recognizes the significance of geographical causes and effects in their bearing, direct or indirect, upon the human

activities which come under their influence. So that the life of a region is best interpreted in the light of geographical conditions, using the term in its widest sense to mean the peculiar characteristics which mark any special region—the nature of its soil and its possible uses, the climatic conditions, the forms of vegetation intimately bound up with these, the remoteness or accessibility of any one region as compared with others, and the consequent growth of towns, and distribution and occupations of the inhabitants.

The region here studied—that of South-West Surrey—possesses an individuality and character that differentiate it from the rest of the county. We have here a remarkable development of the Lower Greensand, which in this district is of greater surface extent than anywhere else in England. Rising on all four sides, it culminates in a massive central block, situated between the Chalk ramparts of the North and South Downs. The different structure and texture of the rocks have given rise to a bolder form of scenery than is encountered in the Chalk ; and in their great elevation, their abruptness of form, and the deep ravines which furrow their sides, these Southern Highlands more nearly resemble true mountainous country than anything else in this part of England. They stand, an isolated tableland, with a steep

escarpment both to north and south, rising into wild hills and high, treeless, heather-clad commons.

It is, above all, a region of strong contrasts, wherein lies its great fascination, offering at choice the desolateness of uninhabited country and the snug comfort of clustering villages. It is a region of heavy rain and of little water, of utter barrenness and of abounding fertility. High moorland overlooks low weald, and sandy wastes neighbour well-tilled fields and densely forested tracts. In soil, climate, scenery, productions, abrupt and sudden changes occur side by side. And it is such geographical causes, producing corresponding effects, which have given their impress to the region.

The region should be studied from its centre—that is, from the massive Sandstone block which rises into the heights of Hindhead and Blackdown. This, while maintaining a high level, nearly touches 1,000 feet above the sea, and stands solid and square-headed, crowned with commons and ringed about with marsh, looking down upon the thick oak-forests of the Weald, and afar to the ridges which bound it, unique in its great beauty, its remoteness, and its sterility.

This is the water-parting of the region, and from its flanks the trickling streams flow north and south, ultimately to reach the Wey or the Arun,

4 THE HIGHLANDS OF SOUTH-WEST SURREY

both of which rivers, or their larger tributaries, pursue well-marked paths bounding the region, and, no less than the Highlands, having peculiarities of their own.

Although Hindhead and Blackdown are only parts of the great central nucleus dominating all else, they form two well-marked divisions, with two aspects—one north, one south—with various points of interest. Between the sister heights, Haslemere nestles in a niche, and many lovely villages lie enwrapped in the folds of the hills. The sweep of a circle with a radius of five miles would include the villages of Fernhurst, Linch, Linchmere, Liphook, Bramshott, Churt, Thursley, Witley and Chiddingfold, and North Chapel, passing through sandy common and wealden clay, and encircling the central heights.

Extended to twice that distance, the line would go westward into Hampshire, and on the south would enter Sussex, and would bring within its scope Rogate and Liss and Selborne; it would pass beyond Woolmer Forest, and skirt the town of Farnham—would pass over the commons of Seale and Puttenham, and go between Guildford and Godalming. On the east it would touch the high commons of Blackheath, and descend to the lower ground beyond Hascombe and Dunsfold, and so through the Fold country of the Weald.

And to all of these it would be easy to walk through pleasant by-ways.

Hindhead, with an escarpment to the north, rises in its highest point—Gibbet Hill—to 895 feet above the sea. Blackdown, reached from the south of Haslemere, rises rather higher—to 918 feet—and is, after Leith Hill, the highest point reached in the Greensand ridge. The southern escarpment is more abrupt in its character than that of the north, and falls to the plain below with remarkable steepness of slope. In its form, though entrenched with deep valleys or coombes, it is more compact than its sister height of Hindhead. This, as a study of the map shows, and which is still more striking when actually seen, has been scarped and scored relentlessly, and its sides have been furrowed with long, deep valleys, which run from the lower land high into the very heart of the highland, wonderfully straight in direction, with sides of almost precipitous slope. Bare on their upper slopes, these valleys show thick and extensive woodland in their bottoms. Often they are dry coombes, but where very deeply cut, marshy ground or a small stream is generally found.

Nowhere else in Southern England is to be found scenery of a wilder description, or more removed from that peace and fertility typical of

other forms. Such scenery we are accustomed to associate with a wide view over gently undulating country, the rising ground blue in the distance or closed by the line of the sea; a church spire rises from the embowering trees of a well-wooded country, villages cluster amid cultivated fields, and somewhere in the picture is water—a winding river or a placid lake.

But this does not hold good of the general outlook from Hindhead. Here the outlook, though wide and free, is oftenest across barren common and treeless heights. The purple of heather and the brown of fern replace the green of the fields, and the want of water, rather than its presence, is the general rule.

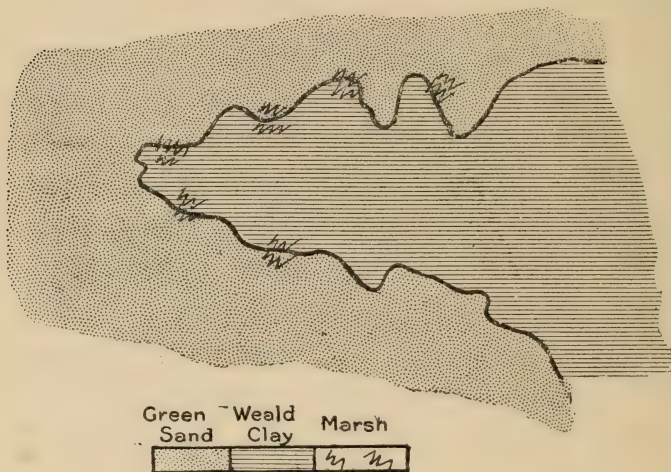
Beyond the Hindhead and Blackdown block, the high ground, falling away steeply, rises again in the more northern Hambledon ridge, which runs out eastward, and reaches its greatest height—about 600 feet—at Hascombe. Here, looking down the slope, which falls abruptly to the Weald, clothed with chestnut-trees, we are told there is nothing more Spanish to be seen outside of the Pyrenees. Northwards from Hindhead, stretching east and west, the sandy country still extends, but growing more fertile as it approaches Godalming—a change in the soil here accounting for well-wooded country, luxuriantly

productive. A line of poor land, moderately undulating, though rising to a conspicuous point in Crooksbury Hill, gives a succession of commons—Witley, Thursley, Crooksbury, and Frensham : this last with three quaint conical sandhills, known as the Devil's Jumps, with fitting legend. In the far distance lies the valley of the Wey, flowing from west to east, until it makes its decided turn to cut a gap through the Chalk ridge of the Hog's Back, by Guildford, and so northwards to the Thames.

Due east the scene is far different. Here lies the junction between the unfriendly clay and sand. Pushing her forests right up to the feet of the sandstone hills, her sturdy oaks in strong contrast to the sand-loving pines, the weald stretches in waving green—wide, immense. Far as the eye can see is the chequered variety of cultivated fields, broken by the darker green of thickly growing copses, lying open to the sunlight—a land of fields and woods, and wheat, and water. This is the “ Fold country,” as it is termed here—the country of farmhouses, of the vanished industries of iron and glass-making, whose raw material came from these sandy heights, of quiet, peaceful old-world villages, such as Chiddingfold, Dunsfold, and many another ; the country which produces, we are told, three things in perfection—oaks, wheat, and grass.

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South of Blackdown the Weald pushes in a long wedge between the sandy highlands to the north and south of it. Clay divides sand from sand, and forms a broken and beautiful tract of country. Here the Southern Highland has its steepest escarpment, and the waters, draining rapidly down to fall against the impervious clay, have given rise to many marshy tracts. Marsh



is frequent in the lowlands, and generally marks this junction of sand and clay, and the steepness of slope from one to the other causes the water to lie more or less in a basin.

The most extensive view is obtained from Blackdown, the highest point looking south. The line of the South Downs, with Chanctonbury Ring well in view, closes the distance, with—on

rare occasions when the atmosphere is particularly clear—a glimpse of sea. Blackdown itself is over the boundary, and so is in the county of Sussex. To the west the three counties of Hampshire, Surrey, and Sussex meet in Hammer Bottom.

Westwards there is not the abrupt transition that characterizes the eastward view. A general higher level is maintained over a hilly country. Woolmer Forest, whose name still reminds us that it was the haunt of wolves, and, beyond, Alice Holt Forest, occupy a large tract of ground, mostly used for military encampments and manœuvres, and the scattered villages are few and wide apart.

The whole region is built upon broad and simple lines. Unlike other parts of England, its history has been easy to read. There are few complexities to puzzle the geologist, and little that baffles study. Nature is in an accessible mood. But the line of study pursued by the geographer, even when starting from the same standpoint, differs from that of the geologist. Their aims are different. To the geologist the surface is of importance so far as it reveals the history of the rocks, and tells of what lies below, dealing with the past. But the geographer is not much concerned with the past history of the rocks. He asks only

how far the surface conditions affect the life thereon, what connection they have with the soil and vegetation, and to what extent human activity may be helped or hindered by them.

Bearing this distinction in mind, we see that briefly the geology falls into two main groups—a large development of sand and a large development of clay. All the rest, if we except the ridge of chalk that closes our region to the north, are variations of these two kinds of rock.

To be a little more precise, and to borrow for a while the language of the geologist, the whole of South-West Surrey, and with it the adjoining portions of Sussex and Hampshire, belong to the same geological period of time—that of the Secondary or Mesozoic—and to a special series of that time—the Cretaceous. The whole of this system, of which our region is a part, is largely developed in this eastern and southern portion of England. The whole series of strata has been subjected to great earth-movements, bending and folding and crushing it, the stress and strain of which has resulted in a broken, dislocated surface, more or less broken, more or less dislocated in character according to the nature of the rocks.

But whatever the position now, whether uplifted in solid blocks, thrown into rolling curves, or stretching in low, undulating surfaces, every

stratum agrees in being in its origin sedimentary, and in its bedding, as first laid down, horizontal. The whole region, disturbed and weather-worn as it is, bears strongly impressed upon it the aqueous character of its formation, and of the same forces which are carving its present surface. The geographical importance of its geology is found in the character it gives to the scenery, and in the economic value of the soil to which it has given rise.

Oldest of all the formations, and, where not exposed, underlying all the other strata, is the Wealden Clay, which covers a large area of the Southern Counties, and extends westward in the form of a wedge between the sandstone ridges. Eastward it expands to north and south, and forms a low, undulating surface of great extent. This tenacious clay, blue where freshly exposed, brown elsewhere, is of fluvial origin, and in this differs from the stratum above, younger in geological age and forming a much thinner deposit—the Atherfield Clay. This crops out in a narrow belt, marking the transition between the Wealden Beds and the Lower Greensand, itself included in the Lower Greensand, though this is a classification not undisputed. Inliers of this brownish clay are found right in the midst of the Greensand in every depression or valley

where denudation has been able to wear away the superincumbent sand down to its surface.

Slight as its outcrop is, and of little extent, it is of direct economic importance, and geologically marks the change from river to marine conditions. This marine origin is indicated by fossils found in it, and so pointing to the conditions in which, on a land surface sinking below the sea, the great deposit of the Greensand was laid down.

Next in succession come the beds of the Lower Greensand, also marine in origin, and indicating the position of the sea, which for a long period must have washed the Cretaceous shores, and on whose bed these deep deposits of sand accumulated. The quality of the sand—its hardness or softness and homogeneity, varies greatly, as does its colour—generally yellow to rusty red, and often exceedingly rich in tone. That its name of “ Greensand ” really fits it, may be seen from specimens in which the characteristic green grains of glauconite tinge the whole; but this colour is not stable under atmospheric conditions, in which weathering results in a loss of the green in exposed surfaces.

The Lower Greensand strata are best developed on the west, and form a wide tract of country, roughly square in form, which thins out into long arms stretching eastward to the north and south

of the Wealden clay. It must not be forgotten, in observing the disposition of these various strata, that in the course of long ages their relative position with regard to each other has become curiously reversed, and this mainly through atmospheric agencies. Thus, from the great swelling arch of the domelike Weald, raised by the upheaval of the crust, the upper chalk and sandy beds were denuded and the clay laid bare. The lower elevation of the land to the west resulted in a lesser loss, and denudation, though resulting in the curious and complex forms we now see, went on at a much slower rate. But over the Wealden area, when once the beds of sand exposed the underlying clay, of enormous thickness, the soft and plastic clay, lacking the sharpness and porosity of the sand, became speedily flattened and smoothed by the action of water, and resulted in the present low and undulating surface. But while the clay, once reached, was rapidly lowered, the Greensand Beds to the west, of great thickness, though once the lower of the two, maintaining a higher level and being acted upon at a slower rate, stand out sharply as a highland mass. This, as we shall see later, brought about other changes, the gradual progress of which can still be traced.

The Lower Greensand Beds in all their extent

are far from being uniform. The differences they present are so constant and so well marked that it becomes convenient and possible to divide them into three divisions, called by geologists the Hythe, Sandgate, and Folkestone Beds respectively, after those localities in which they are especially prominent. Each of these beds varies in the character of its scenery and vegetation, and often, when no other outward difference is to be perceived, the presence or absence of certain plants forms a sufficiently sure indication.

The River Wey may be taken as the division between the Hythe and Folkestone Beds, although isolated patches of greater or less extent of either bed may be found beyond this boundary on either side. The Hythe Beds rise to the greatest elevation, and form the bold escarpment overlooking the Weald, and commanding extensive views to north and south. This formation is also the most extensive. The sand and sandstone of which it is composed is fine in texture and firmly compacted together, and contains ironstone and a good deal of chert. This last is a very compact and flinty sandstone, derived from the concentration of silica, which is said to be formed from the spicules of sponges which grew on the ancient sea-floor. This cherty rock makes good road-metal.

The firm nature of the rock and its close grain

account for the fact that wherever the Hythe Beds occur, the land is higher. A very fair proportion of the surface is under cultivation, contrasting in this respect with the Folkestone Beds, although the highest ground, as on Blackdown and Hindhead, is mostly bare heath and firs.

The Folkestone Beds afford a complete contrast. The extent of these beds is marked by a sterile and unprofitable stretch of country, forming a wide belt from east to west, from Blackheath to Farnham Common, and from north to south, west of the Hythe Beds, from Alice Holt Forest, through Woolmer Forest, and turning round the Hythe Beds to the south. From Farnham to Puttenham, Witley Common and Thursley Common, about thirty square miles, all the land is uncultivated. The soil of which they are composed is exceedingly coarse in texture, very loose, and therefore porous to a high degree, and so excessively ferruginous that this formation was formerly known as the Ferruginous Sands. In colour it is often dark, though dust-like patches, and sometimes reddish sand, also mark it.

A peculiar, hard, gritty rock belongs to this formation, which is known as Carstone Grit, or, from its abundant presence in Woolmer Forest, Forest Stone. It is formed of coarse sand and gravel bound together by a ferruginous cement ;

it lies loose in stony layers amongst the dust-like sand of the forest, and breaks with a metallic clink. From the quantity of iron it contains, it is also known as ironstone, and is valuable for road metalling. It is largely quarried for this purpose both in the forest and at Trotton. Much of the excellence of the Portsmouth Road is due to the use of this stone.

Isolated patches of the Folkestone Beds are met with in the Hythe formation, and always show the same sterility and coarseness of grain. To these are due Munstead Heath, Highdown, Farley, and Blackheath, all of which occur south of the Wey. Being of a less compact nature than the Hythe Beds, they never reach the same elevation, but form a series of heaths and low, wooded hills.

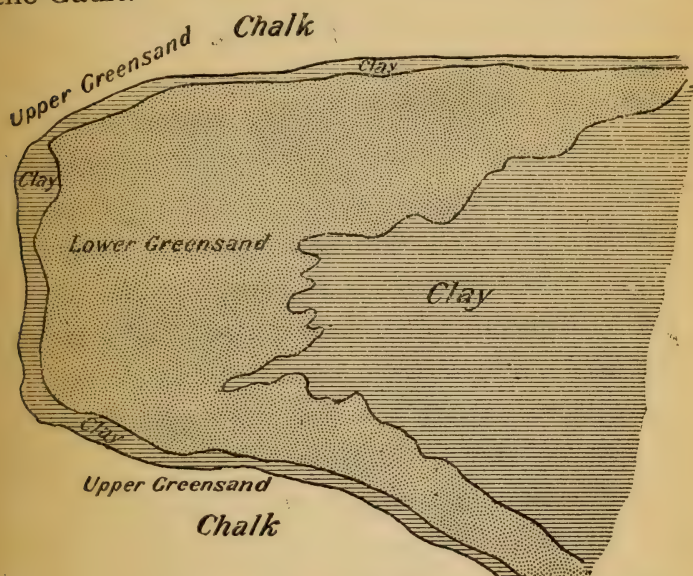
The Sandgate Beds, of no very great extent, lie to the west of Blackdown and Hindhead, and divide the Hythe Beds from the Folkestone Beds, continuing south and east parallel with these. They are very variable in their nature, consisting of dark, clayey sand and clay, and with very different soil value. Their presence is well marked, as may be seen in going from the Hythe Beds of Haslemere westward to Liphook, and beyond to the coarse sand of Woolmer Forest.

The great mass of the Lower Greensand may be compared to an island, set apart in its character



1. Hindhead from the road to Blackdown (p. 6).
2. Blackdown from the road to North Chapel (p. 6).

as it is from the surrounding land, and hemmed in on all sides by clay. To the east, and partly to the south, lies the Weald, with the narrow band of Atherfield Clay closely outlining the sand, and northwards and westwards and southwards, now wide and now narrow, runs the clay of the Gault.



The Upper Greensand is only slightly represented in a thin outcrop on the north, which gradually narrows as it approaches Guildford. Farther north still, bounding the Greensand and Wealden area, the chalk emerges in the sharp, narrow ridge of the Hog's Back. After passing beyond Guildford, where the Wey cuts a gap

through it, the chalk, stretching eastward, reaches its full development, and passes beyond our boundaries. The chalk marks the end of the Cretaceous Period, within which our region is comprised. Outside, cut off by the line of Downs and the Hog's Back, begin the formations of another geological period and a later age. With this we pass on to the Tertiaries and the London Clay.

Although the geology of the region is of the simple character described, and each of its strata and their varying physical peculiarities so clearly differentiated, other formations are to be distinguished, which appear as isolated patches, sometimes as a group of patches, which mark special differences in their own localities. Such are the beds marked as Hill Gravel, the origin of which seems to be quite uncertain. These are beds of gravel or sand, met with most frequently on the west, but which also occur in fairly large patches eastward on the Wealden Clay. They occur equally on the Greensand, the Gault, Weald, and London Clay.

Outliers of the Bagshot Sands also occur. These are restricted more closely to the north and east, but wherever they are found, the soil reaches the extreme of sterility. For the rest, alluvium is associated with the rivers, and their winding

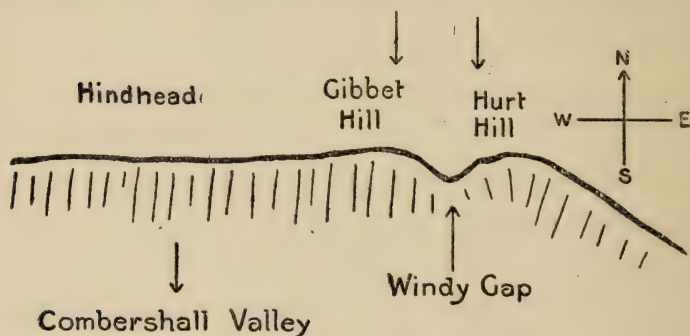
courses are marked clearly enough by the alluvial beds. The narrow band of cultivation in the Wey Valley marks a striking contrast between it and the unproductive Folkestone Beds.

Nowhere is more clearly seen the geographical influence of geological conditions. The wide and lonely commons, covered with low, thick growth, or studded with firs and holly, and rugged hills with precipitous slopes, mark the presence of sand ; and where the great Wealden area spreads to the east and south, thick woods and fields of wheat, with frequent farm-buildings and stacks of straw and hay, show that we are on the clay. It is where the two come into close contact that features of special interest are developed, where each maintains an unequal struggle with rain and water, which often has the strangest results. And of all the strange results nothing is more remarkable than the great valley known as the Devil's Punch Bowl.

It would be well at this point to pay particular attention to the shape of Hindhead as seen on the map. It presents roughly the appearance of a dissected square, and is not unlike those puzzles made up of curiously shaped pieces which have to be fitted together to make up a whole. The pieces wanting here are those hollows which mark the long, deep valleys, running towards the

centre from the north, south, and west—valleys which slant steeply down to their tree-clad bottoms, with wall-like sides, often only covered with a scrub of heather and dwarf gorse, unbroken by any tree or bush, and generally maintaining a remarkable regularity both in their direction and in their width across.

Though the great block has been thus scotched and scored by the hand of Time, and has much in



HINDHEAD AS SEEN FROM HASLEMERE.

its variety of true mountain form, it still shows its plateau origin in the long, hard line it lifts against the sky (best seen from the south), scarce broken save by the notch made by the depression which is called Windy Gap. But viewed from the depth of these steep valleys the impression is a different one.

The solution is simple, though it passes the power of the imagination to conceive of the

period of time involved, and the slow, incessant working of the natural forces which have brought about this extensive carving of a plateau surface. The causes are two: first a sandy and porous soil resting upon a substratum of clay, and secondly a very heavy rainfall.

Hindhead, by its almost thousand feet of height and its position, is favourably placed to intercept the south-west winds, and to receive a much heavier fall of rain on its south-western than is the case on its eastern slopes and on the lower land farther north. It will be noticed that the cutting out of gorge-like valleys has taken place very little on its eastern side, where the outline is more unbroken.

Nutcombe Valley, Combershall, the lovely Vale of Cosford, all express the interest and the beauty of these gorges cut deep into the sides of Hindhead, but all fall into insignificance before the largest and most wonderful of them all, the Devil's Punch Bowl. Here the Hythe Beds of sandstone, falling to their extreme depth of about 350 feet, touch clay, and once again clay and sand working together have produced unlooked-for results.

Standing in the bottom of the valley, the bowl-like shape is very apparent, as the sides rise far above one. As you climb the steep sides to reach

the rim, the apparent circular form is still maintained; but viewed from the head of the Bowl, it is seen to agree with the general valley formation in its length and steady northerly direction. It differs from these, however, in the wide, rounded form of the valley head, to which, moreover, the sides slope more precipitously than in the case of the others, producing the bowl-like shape. Here, in the lowest part, instead of the orange and red sandstones, vivid in colour, crumbling in texture, and sharp in outline, is the tenacious yellowish clay, miry and boggy and trampled. All round rise the steep, slanting walls, the upper sides, bare of trees, covered with a multi-coloured scrub of heather, gorse, and whortleberry, with occasional young firs. Lower down the slopes are thickly wooded, and many a winding track leads upward to the road through overarching thickets, and the view, upwards or downwards, is through a slant of trees.

Trickling streams, fed by the numerous springs, wind their way into and along the bottom—clear little rills of water, all uniting to form a stream which flows out to the north. The whole of this lower part is an impassable swamp, marked by a bog vegetation. The lower slopes, which look so smooth and easy of ascent, clear of the thick scrub which clothes the rest, form a boggy surface, over

which the water ceaselessly trickles, and where the soft green masses of the water-logged mosses, in cushion-like tufts, yield under the pressure of the foot. Looking up the 300 feet of slope to where Gibbet Hill marks the highest point, it seems as if the sands that are piled so high have here exposed their very foundations. And this is what has actually happened.

The atmospheric forces of Nature, wind and rain and frost and heat, have leagued with Nature to accomplish this work. Below the thick beds of sandstone lies the Atherfield Clay, a permeable upon an impermeable stratum. Much of the heavy rain that falls upon these hills, sinking through the porous sand, has given rise to many springs, the unceasing action of which has worn away, in the course of time, this great depression, sloping to the north, the largest of all the valleys in the massive sandstone block which forms Hindhead.

From the great curve of the Bowl, the long, steep sides to east and west lengthen out into Highcombe Bottom (written Haccombe Bottom on the older ordnance maps), and the numerous wavering little rivulets, which have united into one, flow on as the long, straight, narrow stream which is called Small Brook, and which flows through Thursley, until it finally joins the River Wey near Elstead.

From Hindhead northwards and north-westwards the general aspect is of a very uniform character, due to the wide extent of commons and the same geological formation, broken only by the valleys of the branches of the Wey and the more abundant vegetation of the deeper valleys. The road from Hindhead to Farnham crosses moorland the greater part of the way, and offers a view of low, rolling hills, of dark heath, wanting altogether in trees for the most part. Seen from the tops of the ridges which the road crosses in succession, the long line of the Hog's Back closes the view in one direction, and in the other the height of Hindhead. One exception there is, however, to the noticeable absence of water in this landscape generally—an exception which, consequently, assumes an importance that is entirely disproportionate to its size.

Here, set in cheerless moorland, a shining pool sunk in the midst of shadeless waste, Frensham Great Pond gladdens the sight. It is only about two miles in circumference, but this is a large body of water for the region. No plants or grass grow very near the water's edge, which is bordered by the sterile sand. If a handful is taken up and examined it is seen to be identical with the sand we find on the seashore: a handful of rounded, water-worn grains, nearly

all pure quartz. Small food for plants is here. Over the common across which the road is made the vegetation is of the sparsest and poorest description, and large sandy patches are guiltless of any growth at all. We scarcely need to be told that here is Folkestone, mingled with Bagshot Sand.

Blackdown, the southern part of the great central mass, though only separated from Hindhead by the depression wherein lies Haslemere, and composed of the same Hythe Beds, is more compact and far less worn. Its southern and south-eastern slopes are characterized by great steepness, and, viewed from the vales below, the escarpment falls with great suddenness. It is more wooded than Hindhead, with thick, hanging forests of pines on the south sides, the sombre hue of which, seen from a distance, perhaps accounts for its name. The valleys, though deep, do not penetrate so far into the heart of the mass as is the case with Hindhead. Both are exposed to a heavy rainfall and considerable erosive action, but this may be minimized on Blackdown owing to the protection of the thick woods which cover the sides most exposed to wind and rain. That such wind and rain act with considerable effect in open spaces may be seen in the solitary pines which stand here and there among the heather,

old in years, but of stunted growth, with all their branches turning away from the direction of the prevalent winds.

The summit shows a wider plateau surface than does Hindhead, where the many and large valleys, cutting backward, tend to reduce this surface to a ridge. But the same common crowns both, with like forms of vegetation ; yet Blackdown has a richer colour, and in its admixture of the three forms of heather, (the deep-hued, fine-leaved heather growing more thickly here than on Hindhead,) the gold of gorse, the deeper colours of the bracken, and the different greens of whortleberry and fine tufted grass, with clumps of harebells in the finer soil at the roadsides, the effect is that of a planted garden.

The view southward from Blackdown is strongly in contrast with that from Hindhead. It is the contrast of sterility with fertility, for here the Wealden clay runs up to the foot of the hill, whilst beyond the recurring sandstone ridge of Midhurst and Petersfield stand the South Downs.

The most impressive view of the Central Highlands is from the low-lying land of the Weald. Seen close at hand, at Witley, or ascending to Haslemere from Chiddingfold, they loom with all the advantage of their steep escarpments, rising from a comparatively low level. The

northern ridge beyond, sinking somewhat, but rising again as it pushes eastward, continues the same boldness of outline, and possesses the same features of high heathery common and heavily wooded slopes. The somewhat undulating outline rises to 500 feet in Highdown Heath, north of Hambledon, and to 600 feet in the culminating elevation of Hascombe, where it falls away to the plain with all the steepness of Blackdown, although with lessened height.

The steepness of descent from the Highlands to the Weald is often abrupt, and always rapid, rising or falling with considerable angularity of slope. Perhaps Fernhurst affords the best example of this. This village, in the angle of the Weald, south of Blackdown, is between 200 and 300 feet above the sea. North-east of it rises the highest point of Blackdown, with its 918 feet. North-west the high ground rises over 700 feet in Moses Hill, the highest point of the Marley Heights, a continuation of the Blackdown plateau. Steepness of descent marks the road all the way, and in one part the fall is more than 300 feet in one and a half miles.

Reference must not be omitted to the lanes which are so characteristic of the sandstone. Their depth below the land on either side suggests, as is actually the case, that they have been worn

deeper and deeper by the erosive action of water. Deep gullies torn in the soft sand are often seen in these lanes after heavy rain. Very often, too, they furnish the best opportunities for studying the stratification of the rocks.

Below the fields or wood above them, the sandstone rocks rise high and bare. Fresh faces of the beds are constantly exposed as the soil is cut down and weathered. This, together with their steepness of angle, does not encourage the formation of soil, as one generally finds on banks, so that mosses, lichens, and fine tufted grass, which take advantage of every crevice and ledge, are often the only vegetation.

The effects of erosion are striking. The very roots of the forest trees are exposed, massive, twisting, grasping, laid bare by the removal of the soil. The trees seem to hold themselves erect by main force of root, and bar the onslaughts of the weather. The tussle between natural forces is here seen in a wonderful way, especially in the adaptive powers of trees, which, by their entwined roots, interwoven fantastically to form a wall, seem to replace the rock that, solid as it so often looks, is so soft that a stick pushed into it meets with little resistance.

The depth of the lanes is often surprising. It increases on a downward path, and rises up from the sides to a height of 10 or 12 feet, or even more.

In one lane on the Godalming road, between Hascombe and Hambledon, the sides rise to the height of cliffs in places—over 30 feet. There is often a side-path which runs along the top high above the road. The usefulness of this can be seen when it is realized how bad and difficult to traverse the roads become during wet weather.

Such lanes are frequent in the sandstone district, but few can be more beautiful or interesting than Church Lane, which leads from Bramshott to Waggoners' Wells.

To understand the forces which are at work in the region, carving out its features and forming its soil—forces which are small in their immediate effect, as a general rule, but incessant in their action—it is necessary to study the rivers and the distribution of the rainfall.

BOOKS

There are many interesting books upon Surrey, but few have any special geographical bearing.

"Selborne," by Gilbert White.

"Rural Rides," by William Cobbett.

"The Victoria History of Surrey."

"The Victoria History of Sussex."

"Guide to Haslemere and Hindhead."

"The Geology of England and Wales," by Woodward.

"The Scenery of England," by Sir J. Lubbock.

"A Local Geology for Amateurs and Beginners," by J. B. Fowler. Science Paper No. 3: The Haslemere Microscope and Natural History Society.

II

River characteristics—The rivers of the Greensand and the Clay—The Wey and its peculiarities—The change of land surfaces—The case for river capture—Rainfall on the central heights—Over the Weald—Irregularities of distribution—A wet year—Dry years—Surface water other than rivers—Waggoners' Wells—Frensham Ponds.

THE rivers of South-West Surrey are impressive neither by their number nor their size. They fall into two groups, one of which is collected northward into the Valley of the Wey, and the other, consisting of a number of tributaries of the Arun, flows southwards towards that river, which does not belong to the central region at all.

The High Street of Haslemere lies on the actual watershed, nearly 600 feet above the level of the sea. Westward flow the streams which form the earliest branches of the Wey, eastward those which later join the Arun.

From the map we gather an idea of the distribution of the rivers, their relative size and number, and the greater complexity of network where branching streams run over the Wealden clay.

The natural features of the land and the rivers have a very close connection, and react one upon another. The rivers in this case have not only been modifying agents, but their form and character are in accordance with the nature of the surfaces over which they flow, and they themselves give an indication of the structural features of the region. Thus, the Central Highland mass is, to a certain extent, defined in outline by its streams. These radiate in all directions, but are marked especially in the north. They mostly flow in long straight lines, thus emphasizing the position, shape, and aspect of the long, deep valleys which furrow Hindhead. The longest and most marked of all, as we should expect, flows from the Devil's Punch Bowl, through Highcombe Bottom, and, under the name of Small Brook, joins the Wey at Elstead.

The sources of these streams of the Lower Greensand are generally at a considerable elevation—about 500 or 600 feet above sea-level. This height above a plain, to which the escarpments fall with considerable steepness, results in a swift current and increased erosive action in these rapidly flowing streams, running over an easily weathered soil. Swiftmess, clearness, sparkle, characterize these small and narrow streamlets, with clean, sandy beds.

There is a difference in the rivers of the clay. These flow over a flatter surface, with diminished speed, and meander greatly. Not here are the straight and simple lines of the sandstone rivers, bound in their steeply shelving valleys. Here they wander over a wider surface ; a network of rivulets join to form every little stream, and there is more water everywhere, though less rain falls over the Wealden area than over the Greensand heights. Their action, too, works over greater spaces. How this question of water and rivers is closely connected with the vegetation, and also has affected the growth of villages and towns, we shall see later.

Some rivers pursue an uneventful course from their birth to their final goal—the sea. Calm, serene, and beneficent, they carry peace and fertility wherever they flow. Others follow a headlong path, and, falling from the heights, rush through the land, tearing gullies in the soil, and carrying much of it away to be cast down elsewhere. These also have their task, of tearing down and building up.

But the little Wey is different. In itself it is an insignificant river, merely the tributary of a larger river, only of real importance in its own vicinity. Nevertheless, whether it is cleaving its way through solid rock, making sudden, un-



Photo, West & Son, Godalming.

Roots exposed by erosion of the soil (p. 28).

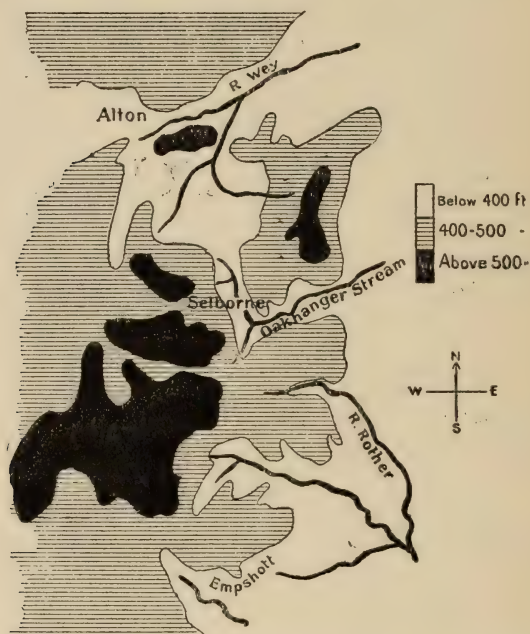
expected turns, or stealing a march upon another river, it is full of surprises, and has an individuality of its own.

In the history of any river certain salient facts stand out with peculiar force. Among these are the apparent determination with which it will follow a given course, not to be turned aside by the greatest obstacles, and the changes that ensue as it passes from youth to maturity and old age, with a record of gain or loss. The same laws of Nature seem to be at work that are active in animate forms, and the same terms of life are used to describe each. So far the Wey may be considered a typical river.

The river rises from more than one source. Two of these lie in Hampshire, and one in Surrey. It is quite possible to go from south to north in the direction of Farnham, and cross three separate branches.

That one which is generally regarded as the most important, and which, geographically speaking, is of the greatest interest, rises not very far from Alton, though as to which of several small divergent streams is the right one seems to be a matter of opinion. Its direction is at first north, but soon changes to the north-east, and the river, still rather small, enters Surrey at Farnham. Just near its source at Alton is a gathering of

streams, for its largest tributary, the Oakhanger Stream, rises not very far from it, close to Selborne, and flows very much in the same direction. Separated only by the high ground to the south



THE SOURCES OF THE WEY, THE ROTHER, AND THE OAKHANGER STREAM.

of Selborne is the birthplace of another river, the Rother, which we shall meet again farther south.

A second branch of the Wey has its origin in Woolmer Forest; receiving an equal branch which comes from just beyond Liphook. But the longest stream is that which passes through Bramshott.

This has its source not very far from Haslemere, and flows from the Critchmere Trout Ponds, which are fed from its springs. The streams from Liphook and the Forest flow in a northerly direction, that from Bramshott to the north-west. Having at length met, their course is thence rather east of north, and the Oakhanger stream comes in about three miles above their junction.

The course of the second branch of the Wey is now taking a direction parallel with that of the first, which in both cases is to the north-east, and at a distance apart of about three miles.

In going from Haslemere to Farnham, the road passes near the Critchmere Ponds, and crosses the commons in a succession of ridges. Each of these ridges falls steeply down to a valley-bottom in which is a river-bed. The Wey is first met a little below Frensham at a place called Millbridge. It is already wide and deep, flowing rather rapidly. At Farnham the second branch is crossed, flowing through the middle of the town; but though this is considered the main branch, it is narrower and shallower than the one at Millbridge.

It is at Farnham that the river makes its first sudden turn, a surprising deviation from its hitherto northerly course, and flows instead at a right angle to the south-east. At Tilford the Bramshott branch joins it, and they are hence-

forward one, flowing on with a steadily eastward course to Godalming, a river of considerable importance to its neighbourhood. It receives many tributary streams from the south, all of them small and almost parallel to each other. Very few streams enter from the north.

At Godalming the river changes its direction for the second time, with almost as much abruptness as at Farnham. It heads for the north, and cleaves a gap between the chalk ridges which bound Guildford to the east and west, and winding between the high walls of this short cleft, continues its journey to the Thames. From the south-east comes one long stream, drawing with it a few smaller tributaries, by way of Bramley and Wonersh, and joins the Wey between Godalming and Shalford.

One other tributary must be mentioned before passing on, less for any small importance that it may possess than because it is not always there. This is the tiny Bourne, lying in a valley which is midway between Millbridge and Farnham, and separated from these by a ridge on either side.

This small river is representative of others found, not only in Surrey, but also in other parts of England, which often have the same name—rivers which lack a constant flow of water, the beds of which are therefore dry at periodic intervals.

The time varies with the river. In the Farnham Bourne water^{is} only present in the winter. In summer, beneath the fairly wide bridge which spans it, is only a narrow, winding sandy bed, a river without water, but with a bridge, a bed, and banks. A small village has grown up round it, whose name, after the river, is Bourne.

This must not be confused with the Bourne Brook, which rises near Bagshot, and also flows into the Thames.

A belt of alluvium marks the course of the Wey. The value of this can be appreciated by anyone who makes a cross journey over the uncultivated moors, and then descends into the river valley. It occurs each time the Wey is met, at Millbridge and at Farnham, and the contrast is striking. The change in vegetation is often quite abrupt. Heather and dwarf gorse mark the stunted vegetation of the coarse sand. As it begins to improve in quality, the pine-woods hang upon the hill-sides ; bracken makes its appearance.

Suddenly these cease. We have entered the fertile belt of river alluvium, and green meadows with cattle, cultivated fields planted with root-crops, take their places. Here and there are fields of wheat ; ricks of hay and straw gather round farm-buildings ; horses are drawing the

plough through brown earth. With as great a suddenness as it began, it ends. The bracken, the pine-woods, the heather, reassert themselves, and continue to do so until again, with the river, we reach the rich alluvial soil. It is not very wide, this fertile belt, perhaps not more than two miles near Farnham, but its value and productiveness mark it off sharply from the barren soil bordering it.

But the greatest interest of the Wey does not lie in its belt of cultivation nor its many sources. These things are common in rivers, but the Wey is individual. We have seen that at two points in its course it changes its direction, abruptly and completely, and that once the change takes place at Farnham and once at Godalming.

Surrey can show other rivers which behave in exactly the same way. The gap of the Mole at Dorking, and that of the Arun through the South Downs, to mention only two, show the same cutting through of a barrier. To go farther afield, in Europe the Rhine and Meuse give examples on a grander scale; and in the eastern part of the United States of America, the great wall of the Appalachian Mountains is notched with transverse gaps, cut by the rivers which flow seaward. The reason in all these cases is the same—the river is older than the hills

which bar its passage, and the transverse gap is a lasting memorial of the course it followed in distant geological ages.

To reconstruct the ancient land surfaces which determined the course of the Wey, and the other rivers of Southern England which behave in a like manner, we should have to go back to the period when the Weald was upheaved, and the curvature of its dome formed the water-parting of the region.

From this lofty height, which ceaseless erosion has reduced to its present low and undulating surface, the streams flowed north and south. No ridges of chalk in either direction blocked their paths, which must then have followed the lines they now take through the Downs. The slow erosion of the central dome and the elevation of the chalk took place so gradually that the rivers were able to maintain their level, and, cutting downwards as the land rose, deepening and widening their beds, their path became a gap in the hilly ridges.

The watershed itself changed gradually also, as the Wealden surface wore lower and lower, and was removed farther to the west, where the sandstone beds, which had better resisted erosion, had now become the highest land of the region. This probably brought about a corresponding

change in the atmospheric conditions, which resulted in the heaviest rainfall taking place farther west also, and, as we shall see, the amount of precipitation is greater over the Greensand than over the Wealden area. All these changes must have had important bearings upon the courses of the rivers.

One tributary of the Wey is marked upon the map, small and of no great importance, which is without a name. It is one of the very few which come from an easterly direction, and it joins the Wey above Godalming, not very far from Shalford. It suggests what may have been the ancient course of the Wealden river, and the thought suggests itself that perhaps this obscure stream may be the very original river itself, though dwarfed and curtailed.

But the Wey presents us with another problem. We may explain its cutting of a gap in a range of hills as the river maintaining its right of way, and as a clear indication of former geographical conditions, but the change of direction at Farnham arises from quite a different cause.

A study of the paths pursued by the two branches of the Wey would lead to the conclusion that the more southerly, or Bramshott stream, is the main one. This would be consistent with its general direction, which is all in one plane,

and so continues on as far as Godalming. But it is not the case with the Farnham branch. This flows in a north-easterly direction, parallel with the Bramshott branch, as far as Farnham, and its obvious course would be to continue that direction, a course which would lead it straight into the River Blackwater, with which it would become one. But this does not happen. At Farnham it takes a direct and sudden turn to the south-east, the angle it makes being quite a sharp one.

Just such a sharpness of angle is noticeable in the Blackwater itself. This river rises to the south of Aldershot, and, flowing at first eastward, with a sudden abrupt turn bends to the north. Both the Wey and the Blackwater here form what is called an "elbow" of capture.

The two rivers are separated by about two miles of distance and by a low rise in the ground. The soil between is largely alluvial. It seems very certain that here we have a case of capture. This north-easterly direction was probably the original course of the river, which formed the head-waters of the Blackwater, a very much larger river than it is at present.

If so, the Bramshott branch would have really been the main stream. The south-eastern part of the river from Farnham to Tilford was probably at first a tributary of the Wey, which,

working backward, at length tapped the waters of the northern river, which henceforth flowed on with the loss of the whole of its upper stream.

The other rivers of the region call for slight comment. The most important is the Rother, a large tributary of the Arun. As the Wey crosses



PROBABLE DECAPITATION OF THE BLACKWATER.

the region on the north, so does the Rother occupy a similar position on the south, flowing with a sharply zigzagged course. It rises a little south of Selborne, and for some little distance keeps its southerly direction, but farther on turns eastward, and continues so until it meets the

Arun. Its largest tributary stream is received from Hampshire, but it is also fed from the slopes and valleys of Blackdown, though most of these small streams are less than those that Hindhead sends to the Wey. One stream, however, that takes its rise near Haslemere, is larger than any of the others flowing from the central divide, with the exception of the head-waters of the Bramshott Wey. This is the Anstead Brook, the course of which lies to the east, in the direction of Chiddingfold, and which finally joins the Arun.

An attempt was made to connect the Wey and the Arun by means of a canal, but the project was a failure. It is still marked on the ordnance maps as the Sussex and Surrey Canal, but against it is the word "disused." In many places it now does not even contain water, and the dry bed is overgrown with grass and flowers.

The valleys through which the streamlets flow to join the larger streams of Wey and Arun, the deeply sunken lanes between high, rocky banks which so strongly suggest watercourses, are largely due to the action of rain. Round Hindhead and Blackdown the rain falls in torrential showers, which swamp the roads and tear gullies in the crumbling sandstone.

Farther east the rainfall is less heavy, but is still higher than that of more northern Surrey.

From the diagram facing page 118 an idea can be gathered of the close connection of high rainfall with increase in elevation and the direction of the prevailing wind. It must not be forgotten that the greatest height reached approaches 1,000 feet ; but a general elevation of 400 feet marks the high ground, and this contour seems to be decisive as regards the general distribution of the rain.

The diagram in which these records are shown gives the result of ten years' observations, which are well kept in some of the towns and larger villages. For some there is often no separate record at all, but the atmospheric conditions acting over the wide and uniform area of the Weald cannot suffer much variation. The true contrast is between the hill country, with its head thrust into the soaking mists, standing opposed to the onward sweep of the winds, and the plain some hundreds of feet below. In the higher land the records are to hand, showing quite clearly the influence of the sandstone block on the localities round it.

The wind, laden with moisture from the not distant sea, strikes these hills from the south-west, and is deflected upwards into the colder strata of the air. The result of their expansion and cooling is traced by the gradually increasing precipitation as Hindhead and Blackdown are

neared. This is greatest on the windward side, and slackens to a marked degree on the leeward. Its north-easterly path is accompanied by a lessening of the yearly average fall as it moves towards Farnham and Guildford, but towards the north-west there is a perceptible rise.

The greatest fall of rain is at Linchmere, a village on the south-western slopes of Blackdown, with a yearly average of 37 inches. The influence that position exerts will be seen if this is compared with the fall at Weycombe of 31 inches, a place distant about five miles, but on the eastern slope of Hindhead, and so in some measure screened.

This difference is constant. Against the records of 33, 34, and 35 inches of Liphook, Liss, Grayshott, and Headley (all on the windward side of Hindhead), should be balanced the lower records of 31 inches to which the averages fall on the eastward slopes towards the plain. Haslemere, with 35 inches, a town in a valley 600 feet above the sea, reaps the benefit of a position exposed by height, but also sheltered by its slight depression.

The long path of the wind towards the north-east, with its accumulating wetness, reaches at length the verge of the hills, and it sweeps downward to the Wealden plain with ever-lessening showers. Screened by the higher ground (which, seen from Witley or Chiddingfold, rises like a

wall), and free from the drenching mists which gather round its head, this lower land, with only a yearly average of 27 and 28 inches, has yet, from the nature of its surface, more water. And the rainfall still stands higher than does that of London or of the Eastern Counties.

This belt of comparatively low rainfall stretches away to the northward; but Farnham, in the neighbourhood of Crooksbury, rising abruptly from low, hilly commons, and Guildford, with its high, sharp ridge of chalk, gain a certain advantage of position, and their records fall less low than those places farther to the north.

But in the north-east a growing increase is visible, and this accords with an increasing elevation in that direction. For the rain-laden winds, having winged their way over the heights of Hindhead, to fall with diminished vigour on the plain, have felt the influence of the Hambledon ridge, and rise towards the looming mass of Leith Hill in the far east. This can already be traced where Bramley and Wonersh record their 28 inches, overlooking Dunsfold and Alfold with only 27 inches, less important in actual amount, but marking a steady decrease as the plain widens and the rainfall becomes less.

Interesting also is the rainfall of Fernhurst. This little village, cosily placed at the foot of the Marley

Heights, an extension of Blackdown, overshadowed by the tall hills of Moses and Friday, lies in the angle where the Weald sends a tongue into the Greensand. Eastward it is open to the plain; west, the ground slopes slowly upward. But southward Headley Common marks a rise, which culminates in a long ridge between 500 and 600 feet in height. So that Fernhurst (no distant neighbour of Linchmere, with its high record of 37 inches yearly) falls to 31 inches, no higher than is found on the much farther eastern slopes of Blackdown and Hindhead.

The year 1903 was probably the wettest ever known in this district. Some idea may be gathered of the force and frequency of the showers from the figures recorded, and a comparison of them made with those of the yearly average.

Thus, in Linchmere, which stands highest in the 1903 record, 53 inches of rain fell, a difference from its ordinary amount of more than makes up the yearly average for London. Liss, Headley, and Liphook all received over 47 inches, whilst that of Haslemere rose to 43 inches—well over the average.

It was a year of widely spread rainfall, and the plains shared it with the hills. The eastern slopes of lesser rain registered as much as 43 and 44 inches. Farther away in the north, at Farnham

and Guildford, the fall recorded was over 40 inches. Wonersh and Bramley, whose yearly average shows a rise towards the north-east, consistently rose to 45 and 42 inches respectively, and the most distant corners of the region also had the high record of 37 and 38 inches. It was a record year, and the excess of rain above the average was greatest in the northern part of the district.

This was balanced by the two years which followed. The years 1901 and 1902 had an exceptionally low record—a record which was spread over the entire region. Linchmere and Liss alone in 1902 exceeded 30 inches. Elsewhere even the windward side of Hindhead registered no more than 28 and 29 inches, to mention two instances. In other parts it was much less. Witley, Chiddingfold, and Hambledon fell below 24 inches, and in the extreme limits of the region, at a station at Seale, in 1901 the rainfall registered as low as 18 inches.

It is this comparatively heavy rainfall over the thirsty sand that accounts for the amount of vegetation that we see there. It is important that this porous soil, which dries quickly, and through which water so rapidly percolates, should receive plenty of rain. The amount that is absorbed is great. This is received and retained by the stratum of Atherfield Clay, which everywhere underlies the Greensand, and this is the source of all the water



Photo, West & Son, Godalming.

Frensham Great Pond (p. 50).

used. These villages obtain their water from wells sunk to the water-level—water which is of exceptionally good quality, very clear and pure, and with much of the softness of rain-water. Black-down is made to yield its stores for the benefit of Haslemere. Water is reached at a depth of 106 feet, and is made to supply reservoirs for the use of the town, so that wells have here become unnecessary. The clay holds in reserve abundance of water.

Water on the surface is not common. The want of it is generally the one thing lacking in this beautiful country. Yet one or two bodies of water there are which, from this very fact of rarity, acquire an added importance. They are Waggoners' Wells and the Frensham Ponds.

The first of these, Waggoners', or Wakeners', Wells (for the common name is a corruption), are small lakes of great beauty, three in number, which lie in a lovely glen, a mile or so beyond Bramshott, and about six or seven miles from Haslemere. Buried in the midst of forest, overhung by pine and beech trees, surrounded by a tangle of vegetation, and spread with lilies, they are quite unique in this region.

The lakes are on three levels, so that they drain into each other, and from the lower end, fed also by springs from the wooded sides of the steep

valley, issues a small, clear stream, a tributary to the Wey. The Wells are not a natural formation, but were made, not without protest, by a former lord of Bramshott.

Larger than Waggoners' Wells are the Frensham Ponds. No greater contrast can be imagined. The Frensham Ponds lie between Haslemere and Farnham, rather nearer to the latter town, in the midst of open country, unwooded, untilled, bare sandy common. They are two—Frensham Great Pond and Frensham Little Pond—each invisible from the other, separated by a ridge of low rising ground. The soil is coarse and bears only a scanty growth. Instead of the deep seclusion amid hanging woods of the Waggoners' Wells are here only tufts of ling intermixed with dwarf gorse, and the waters lie open to the sky.

Both Great and Little Ponds have the same aspect of forlornness—water placed in the hollow of barren land. The highroad runs close by Frensham Great Pond, which is the larger of the two, two miles in circumference. Close down at the water's edge, the water, washing up over light, loose sand, recalls the sea, with its strip of beach. From both of these ponds small streams flow westward into the valley of the Wey.

The amount of rain that falls over the Central Highlands is, we have seen, the heaviest. This is

the outcrop of the Hythe Beds, fine-grained and often very productive. But over the Folkestone sand region, together with a poor soil, large-grained and excessively porous, which loses its water with great rapidity, the rainfall is much diminished. These factors cannot fail to be of great significance when these soils are considered in the light of the plant growth to which they give rise, and which they will support. On the other hand, the Hythe sandstones in the region of heaviest rain are also the highest in elevation, and so become the centre of a system from which water drains away in all directions, and percolates to a considerable depth, while the coarser sand of the Folkestone Beds lies at a lesser elevation. Between these lie often the loamy tracts of sufficient rain and of blended soils, where atmospheric and agricultural conditions reach their most favourable result.

BOOKS

"The Development of Certain English Rivers," by W. M. Davis, *Geographical Journal*, vol. v., p. 127.

"Britain and the British Seas," by H. J. Mackinder.

"British Rainfall," 1897 to 1906, by G. J. Symonds and H. R. Mill.

"Surrey: Highways, Byways, and Waterways," by C. R. B. Barrett.

"River Development," by Israel Russel.

"The Relations of the River Wey to the Blackwater and the Arun," by Bury, the *South-Eastern Naturalist*; Transactions of the S. E. Union of Scientific Societies, 1910, p. 14.

CHAPTER III

Difference of soil marked by changes in the vegetation—Sand and clay contrasted—Experiment to illustrate saturation—Varieties of sand and clay soils—Contrasts in vegetation going west—Contrasts in vegetation going east—The nature of humus—Peat as a soil—Sand flora and peat flora—The adaptability of certain plants—The part played by bacteria—Plants of the Lower Greensand—The flora of the Hythe Beds—The flora of the Folkestone Beds—Plants found on chalk and clay—The commons of the Greensand—Marshy land—Bog conditions—The Devil's Punch Bowl—Woodlands of South-West Surrey—Forest problems—Typical trees—Trees of the sand—Beech-woods—The sweet chestnut—Conifers as an economic investment—Surrey lanes—Local colour.

THE structure of the rocks, the soil to which they give rise, and the water which acts upon them, form the three chief factors which determine the kind of vegetation in any district, its distribution and special peculiarities in choice of locality or form ; and this in its turn becomes of importance in its fitness or unfitness for cultivation and the occupation of the land.

In the first instance this results entirely from the natural conditions, but under certain other

conditions circumstances may arise which set these aside; and other geographical influences, formerly ignored, may play a considerable part in their turn. So that, generally, the soil, its fertility or barrenness, the climate and rainfall, the agricultural possibilities, the growth and position of towns, the increase or decrease of population, are intimately bound up with each other.

All this is true of South-West Surrey. To begin with, the conditions of the soil and the resultant vegetation are marked out broadly by the nature of the underlying rocks, and these are so decisive that it may be roughly mapped by the character of its vegetation. Thus, the Weald, a great development of clay, may be traced across the map by its wealth of woodland, formerly more extensive than at present, but still remarkably thick and abundant. Standing on Hindhead, one looks east over thick forest, and turns north and west to view the treeless commons which indicate the difference of geological formation.

It has been already shown that two classes of rock, which give rise to two soils, occupy the whole of this region, which is bounded by chalk. These two soils are sand and clay. In these two, so different and yet so constantly associated, is struck the note of contrast that is found all through the district. To understand all that this means,

the nature of these two rocks or soils deserves some attention.

No two soils present a greater antithesis, and sharp contrasts occur side by side when the opposing soils come into juxtaposition ; but where they join forces to a greater or lesser degree, the product is a soil which ranks among the best and most fertile in the kingdom. Winter and summer, cold and heat, are not more strongly contrasted than these two soils, which stand out clearly with their own peculiarities, and bear their own peculiar flora, so that the natural law seems laid down for much of the plant world, "Thus far and no farther."

In the sand itself, as we have seen, differences exist, as it contains more or less of humus—that is, soil derived from organic sources. Thus the Bagshot Sands are the hottest, driest, and most sterile of all forms of soil. Next come the Lower Greensand, then the chalk, and lastly the clays—Gault, Wealden, and London clay.

Sands, together with peat, are distinguished from all other soils by producing plants which are often peculiar to themselves, which, in the case of sand and peat, may differ from each other, although certain forms may be common to both.

Sand differs from clay in containing little or no nutritive value. It is therefore sterile in proportion as it is more or less pure, quartz sand

being absolutely devoid of nourishment ; but its nutritive value is increased in so far as lime, mica, or felspar are present. Clay, on the other hand, is the richest of all soils in the amount of plant food it contains, but its tenacity is so great that this plant food, with few exceptions, is only available with extreme difficulty. In the matter of porosity and water capability, clay and sand stand at the two extremes, and these vary with the exact composition of the soil itself. The value of soil may be largely estimated by its capacity for holding, or raising, water. Sand, especially quartz sand, raises water from the substratum with extreme rapidity, but raises it the least distance of any soil, whilst it is only slightly absorbent. The absolute water-capacity of sand is 13 per cent. of its own volume, whilst that of clay is 40 per cent. But whilst clay retains its water for a considerable time, from sand it evaporates very quickly. Sand is therefore a dry and, because it lacks water, a warm soil ; clay, on the other hand, is wet and cold. The physical structure thus determines the amount of water and the thermal conditions of the soil. The following table is the result of an experiment to prove the different rates at which water will flow through different soils when each is wetted.*

The layers of soil experimented upon were

* "The Book of the Farm," by Stephens.

12 inches in thickness and saturated with water. A layer of water 20 inches thick passed through the saturated soil in the following times :

		Hrs.	Min.
Coarse sand (somewhat calcareous)	..	1	54
Coarse sand (without lime)	..	1	20
Fine quartz sand	.. ..	1	57
Sand from Hartz Forest	.. ..	6	20
Limestone soil (with 11 per cent. humus)		7	94
Sand ground extremely fine	.. ..	33	33
Refractory clay, from a field	.. ..	168	00
Tile-makers' clay	.. ..	252	00

The result of blending rocks which are in so sharp a contrast in their essential qualities, must be to modify the nature of each. Sand added to clay yields loam, but the kind of loam depends upon the proportion in which the constituents are mixed. The varieties of sand and clay soils are as follows :

Sand + clay = loam.

Sand₂ + clay = sandy loam.

Clay₂ + sand = clay loam.

Sand + vegetable matter = light vegetable soil.

Clay + vegetable matter = a heavy vegetable soil.

In the next table is given the proportion of sand in another form :

Pure clay = no sand extracted by washing.

Pure sand = less than 20 per cent. of clay.

Clay loam = 20 to 40 per cent. of sand.

Loam = 40 to 60 per cent. of sand.

Sandy loam = 60 to 80 per cent. of sand.

Brick clay = less than 20 per cent. of sand.

By sand is meant a soil which contains upwards of 75 per cent. of silica.

It is wherever the presence of a mixed soil gives rise to loam that well-cultivated tracts appear in the midst of unprofitable ground. It is owing to such richer streaks, and to the mixed soil of the deep valley bottoms and the lower levels, that we find such oases of cultivation. Thus Thursley and Hascombe and Tilford, lying low amid their commons, have a good loamy soil, whilst close at hand are the sandy stretches of heather and gorse. Even in the Devil's Punch Bowl, just above the swampy bottom, lie several little farms, surrounded by green fields, which contrast vividly with the surrounding vegetation.

But the differences which exist in the sand itself—the coarseness or fineness of grain, its greater or lesser porosity and nutritive value, and special local circumstances—have also to be taken into account. The Folkestone Beds are remarkably poor. This is because of the very coarse texture of the soil, which cannot hold water or resist evaporation, but most of all because of the undue proportion of iron present in this stratum. Iron is one of the ten elements which make the essentials of plant food, but it is also the element of which the least amount is used, and when a large quantity of it is present in the soil, it is actually injurious.

This it is which causes the uncultivable land which forms a wide belt to the north of Hindhead, a region of low, dark, peaty moors, with little to show of the beauty of wild-flowers, for even the heather and the gorse (most hardy and persistent of plants) show more poorly on the Folkestone Beds.

It is very striking to notice how the different character of the rocky substratum, resulting in a difference in the form of vegetation, gives a totally contrasting physiognomy. This is well illustrated in going from Haslemere, through Liphook, beyond Woolmer Forest and Greatham. It will be seen that in this direction, at this particular point, the Hythe Beds are succeeded by the Sandgate, and these by the Folkestone Beds. From the fir- and chestnut-woods of Haslemere, with its absence of cultivated fields, one descends to Liphook, and cannot fail to observe that both the soil and the vegetation have changed. Dark, clayey loam replaces the brilliant reds and yellows of the Hythe Beds. Frequent farms appear, with grassy meadows, and fields in which root-crops, often wurzels, grow. Great spreading oaks are the commonest tree, and reach a height and girth and broad expanse only to be seen in them when growing upon a heavy soil—common enough in the Weald country, but not on the thinner,

poorer soils. In the damp hollows alders grow plentifully and luxuriantly.

Still continuing westward, the ground rises slowly, and gradually a change is noted. Gorse makes its appearance, growing tall and thick. Holly-trees become more frequent. The bracken grows in thickets, 5 to 6 feet high, and the varied heaths glow in many shades of purple. The military road runs on and up, and low hills rise at the side. The low, flat ground is covered with pine-forest, which stretches far to the right, northward and westward. But on the low hills the vegetation becomes less and less. Bracken ceases; the gorse is of the low, flat growth peculiar to this stratum, prostrate on the earth, pushing up its yellow blossoms amidst the shaggy growth of short and stunted ling. Grass grows scantily; it fails to cover the dark earth. Dusty tracks, deep in sand, scar the hill-sides, and bare sandy patches are frequent amongst the heather, which is insufficient to cover the poor soil. The soil itself, occasionally light in colour, here and there with a touch of yellow, is mostly dark, and exceedingly dusty. It is full of loose stones, varying from large to small—the Woolmer Forest stone, consisting of large gravelly grains, bound together by a cement of iron.

Or go eastward, and exchange the Greensand for

the Wealden clay, which runs up to its foot. The transition in the vegetation takes place very quickly as you go from one to the other. To reach the clay from any direction means a steep descent, through lanes cut deeply in the rock, and lovely woods in which the kind of tree which predominates changes as you proceed. Pines and bracken give place to oaks and green fields. Quite suddenly the common ends, and there for the first time you see the brown of ploughed fields. Bracken comes down closest of all to the cultivated land, but this, too, is a plant of the sand very rarely seen on a calcareous soil, and soon ceases when the last of the pines and holly are left behind. The wild-flowers which grow by the side of the road change, and oaks, by their splendid development and great number, proclaim themselves the trees of the Weald.

There is yet another element to which both sand and clay owe much, since it largely modifies and improves the natural characters of each. This is humus, present more or less where there is any vegetation at all. In colour it is black or dark brown, and it is derived entirely from the decay of organic remains, both plant and animal. The addition of humus to a soil increases its productivity, renders it lighter and easier to work if heavy, and reduces its looseness and porosity if

sandy. It has a greater power of absorption, a higher water-capacity and specific heat than other soils. Very little humus is formed in sand, because of its looseness and dryness, which allow the easy admission of air and the consequent oxidation and decomposition of organic remains. This is why sand possesses so little fertility.

Peat is the richest of all soils in humus, and therefore has the greatest water-capacity and the highest water-raising power, whilst at the same time it is almost impermeable. Its tenacity, however, is small, and when dry it easily crumbles to powder. In colour peat soils vary from light to dark brown. They are exceedingly rich in carbon, but are deficient in air and oxygen, and contain little potash and phosphoric acids. Free humous acids are always present, a fact which very much affects the character of a peat vegetation. It only needs the removal of the water and the ventilation of peat by air, and the burrowing work of earthworms and other creatures and insects, to change it into a rich and productive soil.

Peat, which is composed entirely of plant remains more or less decayed, differs from ordinary or leaf-mould humus, which is a mixture of sand and clay, rich in the remains of completely decayed organisms. It is largely found in forests and under trees, and is promoted by moisture and the

work of earthworms, small animals, and fungi, which, by breaking it up, allow the admission of air. The formation of this may well be seen in a beech-forest, where, in the autumn, the leaves, dead and decaying, will form a layer as much as 3 or 4 inches deep.

A sand flora, owing to the dryness of the soil and the rapidity with which it absorbs heat, generally develops early in spring. Peat flora, on the contrary, which grows on a wet, cold soil, flowers often quite late in the year. Certain plants also occur with such regularity upon particular soils that they may be taken as indications of its character. Thus, peat is shown by the growth of ling, the fine-leaved heath, and the cross-leaved heath; and sand by gorse, broom, and bracken. The Scots pine, however, grows on both dry sand and wet peat with equal facility. The reason is that the cold, wet peat soil and the parched sand are alike dry as far as the plants which grow on them are concerned, since in the one case the sand loses its water rapidly, and in the peat the presence of free humous acids prevents the absorption of water, so that in both cases a xerophytic type of vegetation is generally produced, to which the soil is physiologically dry.

It is a debatable subject among botanists whether the chemical or the physical qualities of

the soil are of the greater importance. Much is to be said in favour of each, but the most important point at issue seems to turn upon the question of water. This is usually the determining factor, since the thermal conditions are greatly influenced by the amount of water held by the soil, and this depends upon its physical structure. Thus, plants growing on the sand on the high commons of the Greensand are much exposed to frost, but owing to the dryness of the soil this does not often affect their roots.

The same species of plant can grow on very different kinds of soil if it meets with the same conditions of moisture. This is well illustrated by the common heather, or ling. This grows everywhere on the sandy commons of South-West Surrey. It is also found growing close to water, and flourishes in boggy swamps. Its xerophytic structure, which causes it to absorb water slowly and part with it slowly, fits it for either site. But though we find it limited to poor soils, it will grow to greater perfection on a good one, and its wide distribution over spaces unoccupied by other plants is due to the fact that it has suffered from competition, and it is free to develop unchecked where the more exacting plants, which have crowded it out from the richer soil, cannot exist.

The same thing happens in other cases in which

certain species flourish upon a poor soil where they have no rivals, but are expelled from more favourable soils by competing plants or trees. Thus, the oak is expelled by the beech where the locality happens to be one in which the beech flourishes, and the oak is driven to poorer soil, where it becomes a poorer tree, or to the low, damp situations where the beech will not grow. Hence the wide distribution of the oak in the Weald, and the scarcity there of the beech. Some remarkable instances of the growth of oak and beech side by side can be seen in the beautiful lane by the church in Bramshott, leading to Waggoners' Wells, in which, in one case, a vigorous young beech has entwined its very roots among those of the oak, pushing through them for a grasp of the soil, with a tenacity that is marvellous to see, and which is fully exposed in the high sandstone banks, eroded by rain to the very roots of the trees.

The different behaviour of these three soils, clay, sand, and peat, with regard to water and air is explained by their physical structure, in which they differ as markedly as in other respects. Clay is lamellar, and when hardened becomes shaly ; sand is granular, and peat fibrous.

Another essential difference that has to be kept in mind when studying these sandy commons and boggy swamps is that, whilst all soils contain multi-



Photo, H. & C. Son, Goldthorpe.

A lane near Hambleton (p. 60).

tudes of bacteria, sandy soil has the least. The part that bacteria play in fitting the soil for plant life is important, since their action is often very beneficial, and they increase the richness of the soil. Peaty soil, or any soil containing free humous acids, is almost deficient in them.

The botanist proves, by means of water-culture, that though many plants show preferences for certain definite food materials, yet there are ten essential elements of plant food, each of which is absolutely indispensable to the life of the plant. These are oxygen, hydrogen, nitrogen, carbon, sulphur, magnesium, phosphorus, potassium, calcium, and iron. Of these, nine are taken in by the root from the soil, as compounds, and carbon from the air, in its gaseous form of carbon dioxide. It is now proved that under certain conditions plants are able to utilize free nitrogen, which is an exception to the rule that this gas is usually obtained from the soil in solution, in the form of nitrates. This the plant is enabled to do by means of a form of bacteria, which inhabit the soil and establish themselves upon the roots of certain plants, the relation being, not parasitic, but symbiotic.

So far investigation has shown that this is particularly the case in leguminous plants, which, however, only grow in soils rich in lime, and avoid

sand, but it is possible that this symbiotic action, by which the bacteria (a form of fungus) living on the plant supply it with nitrogen, is more common than is supposed, and it probably takes place in the mountain-pine at least. Peaty or boggy soils are not only deficient in bacteria, but also in nitrogenous compounds, and this leads to the strange results of carnivorous plants, which obtain their nitrogen from organic sources. Hence the presence of sundew, catchfly, and butterwort in boggy places.

It would be a long task to enumerate all the plants growing in our region, when we learn that, out of 1,861 native and naturalized plants found in Great Britain, Surrey possesses no less than 1,081. The variety of its soils accounts for this, and, although the more useful plants, such as wheat, beans, peas, and most root-crops, are the growth of the heavier soils, sand and chalk give rise to a far more varied flora, though, generally speaking, of far less economic value. It must also be kept in mind that, though the sand is poorer in quality, it is a warm soil, and in the southern parts has a plentiful rainfall. Pure air and unhindered sunshine must be added to the other factors.

Some plants, however, are of special interest, either from inherent peculiarities of form or habit,

or in being limited to certain localities, or in indicating a special kind of soil. So that, whilst many of our commoner English plants are found alike on chalk, and clay, and sand, certain plants have become characteristic of these soils.

Marsh and wood and common, bog and heath—these words sum up South-West Surrey. Light, space, colour, and fragrance are the characteristics of these breezy commons, lifted high amid drenching mists, lying open to the sun, swept by pure, strong air. Everywhere is colour, and in the time of its blossoming the effect is that of a garden of flowers. The gold of gorse and broom and the thick tussocks of heather colour whole hill-sides. Even on the commons the type of vegetation varies. The Sweet Gale is said to be found only on the Bagshot Sand. The Lower Greensand is noted for the number of plants which are absent from, or rare on, other soils. All of the following plants belong to the Lower Greensand :

Marsh St. John's Wort, Upright *Moenchia*, Knotted Pearlwort, Petty Whin, Subterranean Trefoil, Hare's-foot Trefoil, Bird's-foot Trefoil, Hoary Cinquefoil, Long-leaved Sundew, Least Cudweed, Mountain Groundsel, Wall Hawkweed, Wood Hawkweed, Narrow-leaved Hawkweed, Whortleberry, Bog Pimpernel, Dwarf Silky Willow, Bog

Asphodel, Heath-rush, Lesser-jointed Bog-rush, Northern Hard Fern, Black-stalked Spleenwort, Narrow-leaved Prickly-toothed Shield Fern.

Among plants confined to the Hythe Beds are : Wall Hawkweed, Common Hawkweed, Pale Smooth-leaved Willow-herb, Lamb's Lettuce, Small Teazel, Water Speedwell, Early Field Scorpion Grass, Yellow Cow-wheat, Sweet Mountain Fern, Narrow-leaved Prickly-toothed Shield Fern.

The Folkestone Beds also show a flora of their own, which includes the following : Knotted Pearlwort, Hoary Cinquefoil, Bog Pimpernel, Marsh St. John's Wort, Long-leaved Sundew, Petty Whin, Heath-rush, Lesser-jointed Bog-rush, Climbing Corydalis, Ciliated Pearlwort, Soft Knotted Trefoil, Purple Marsh Cinquefoil, White Meadow Saxifrage, Dwarf Nipple-wort, Common Sawwort, Marsh Club Moss.

One or two plants of great rarity are not included in the above lists, as the Ivy-leaved Bell-flower, which grows on the peaty soil of Frensham and Hindhead ; the Spreading Bell-flower, still rarer, of Frensham and Thursley ; and the Bog-Orchis on Puttenham Common. Owing to the vicious habit of thoughtlessly gathering flowers indiscriminately, these flowers are on the way to extinction. This has taken place with a native maiden-hair, known as *Trichomanes*, which is

said at one time to have grown plentifully in the neighbourhood.

Other plants are found which are common both to chalk and sand, but are absent from clay. These are : the Common Milkwort, Long-stalked Geranium, Rose-bay Willow-herb, Carlina Thistle, Ivy-leaved Lettuce, Nettle-leaved Bell-flower, Scabious, Viper's Bugloss.

The clay also, with its cold, wet soil, can produce some plants which are peculiar to itself, and not often found elsewhere. The Bulbiferous Coralwort, the Mountain Speedwell, Daffodil, and Awned Nit Grass, belong to the Weald.

All three kinds of heather are found upon the commons : the ling ; the fine-leaved heath, with its large, deep crimson bells ; and the paler, pink-tipped, cross-leaved heath, in drooping clusters—this last always more associated with water than the others. It is the ling which is most widely spread, and which continues to grow where the others have yielded place. Found with the heather, often entangling it with its thread-like stems, is its parasite—the red-stemmed Dodder.

To describe one common on the Lower Greensand is very largely to describe all, though those who know them become aware of individual differences, due to the degree of admixture of the sand with other soil constituents, the direction of

slope, and consequently of sunlight, the exposure to strong winds, and the elevation. Dryness, except in certain boggy spots, is the common characteristic. The soil is generally more or less quartz sand, over which a layer of raw humus has been formed. This is entirely composed of plant remains, interwoven roots, fibres, and rhizoids, which form a dense matwork, tougher and more felt-like than the rich, soft leaf humus of the woods. Heather remains are predominant in it. Its closeness of texture excludes the air, and the presence of free humous acids excludes many plants, which leads to the growth of heather over wide areas.

The remarkably accommodating nature of ling has been noticed before, but, although its tenacity enables it to grow alike on sand, which is quickly dry, and on wet soil, which dries periodically, it requires plenty of atmospheric moisture, open country, and sunlight. These are supplied by the high, treeless moors of a hilly country. It is found in the clearings of pine-forests, or where the trees are not thick, but always where the light falls through. It is a highly social species. The fine-leaved heath, and the cross-leaved heath, or bell-heather, are abundantly mixed with it, though where the soil is exceedingly dry and poor, as in many spots on the Folkestone Beds, the ling alone

is found. On Weaver's Down, between Liphook and Greatham, and round the Frensham Ponds, for example, hardly anything else but very poor ling is found. Whilst all three kinds grow both on Hindhead and on Blackdown, the richer-coloured, fine-leaved heath seems to be much more plentiful on the last, and grows to a greater height. On the commons of the Hythe Beds the ling grows high and very bushy, and where it borders the cart-tracks it is particularly fine. This may be because here it obtains a more varied soil.

Associated with the heaths are bracken, gorse, and broom. The bracken, however, abandons the highest and most exposed situations, but grows to a great height, and on the lower slopes leaves no space for the heather, perhaps because it excludes the light. Gorse closely follows the heather, and, where the soil is not too poor, grows tall and luxuriantly ; but a strange little dwarf form occurs on the poorest soils, notably on the commons of the Folkestone Beds, called the Petty Whin, or Dwarf Gorse. It is low and flat in its growth, and presses its stems closely against the earth, a green prickly mat. Where this form of gorse grows, the ling or other heaths are also low and sparse, and the two are closely connected, but grass is nearly always absent. Elsewhere the grass of the heather commons is of a particularly

fine and beautiful form, with thin and filiform leaves, of a tufted growth. Such grass, exceedingly silky and long, may be seen hanging its tufts down from the crevices of the sandstone rock in many of the sunken lanes. Tennyson's Lane, leading from Haslemere to Blackdown, is a good example.

But the whortleberry, itself a tough and wiry little plant, holds its own with the heather in covering large tracts. Lower in its growth, it pushes its bright green leaves close under the woody stems of the heather bushes, and leaves no space uncovered. And the Golden-rod must not be forgotten, scattered throughout the purple heather; for while that grows in close and continuous tussocks, the Golden-rod, with its winged seeds, plants itself anywhere. Where the fine, long grass grows, nearest to the road or in clearings amongst the heather, often pushing close up to the tall bracken, harebells are thick.

Wide and open as are the greensand moors, trees grow singly or in little groups, and the pine, the holly, and the birch are the prevailing forms. Like the heather, the pine and birch are almost indifferent to site, whilst the holly loves a sandy soil better than any other. But it is on the lower slopes, not on the high, bare, wind-swept exposures, that these trees really count. Each

tree, standing alone on the heights, has to do battle with the weather, and bears the marks of the struggle.

Thus, as one descends from the high commons the variety of plant life increases, and large spaces are not so often exclusively occupied by a single species. The bracken grows right down until the soil becomes too calcareous for it ; for this plant, though not strictly limited to the sand, is yet very rare off it, and, though it grows in the oak-woods and amongst the birches and scattered firs, it, too, requires plenty of open space and sunlight.

The woods have their own flora, more limited, it is true, but often extensive enough, and on shady banks or carpeting the ground under the shadiest trees the ground is green with the bright leaves of the wood-sorrel. Fungi of all kinds flourish, both on the mossy soil and in the shade of the trees. Those found in this district are many and beautiful, and include many rare varieties. Mosses and lichens grow where any tree, or wall, or other plant will afford them a footing.

The richness of the vegetation on these poor soils—in spite of their dryness, the great elevation often, the exposure to early and late frosts, and a deficiency in food material, or in other cases

the excess of humous acids—is due to the fact, mentioned in the case of heather, that many of these plants cannot hold their own on richer soil, among stronger competitors, but find a free field on the poor soil to which they have adapted themselves; therefore under such circumstances xerophytic and marsh types flourish, where the broad-leaved, moisture-needing plants could not exist, for the most part. The rule seems to be, not so much that a rich soil is necessary to plant growth, as that they can obtain the essential elements, and thus they are often impartial, except in cases in which chemical and physical conditions are carried to extremes which expel certain classes of plants, as common salt, and abundance of lime or water, each of which develops a peculiar flora. The foxglove and the beech belong to soils which are deficient in lime, other conditions being of less importance. The difference between the flora of the Hythe and the Folkestone Beds is certainly due to chemical rather than physical differences, an excess of iron being a very important point.

But, if we except the coarse and sterile nature of the Folkestone Beds, with their excess of iron, and the higher commons of the Hythe Beds, the rest of the Lower Greensand contains much good ground. The frequent streaks of clay amongst

the sand, and the abundant humus, produce a fertile loam resting upon a sandstone foundation, which repays cultivation. Many of the outlying villages of the greensand lie amidst such productive tracts, which, though limited in area, can hold their own with any in England.

Anyone passing through this district cannot fail to have noticed the fertile and well-cultivated country round Godalming. Godalming itself, the second town in importance after Guildford, lies in a valley, sheltered on all sides by low hills—a perfect nest of verdure. This is the richest tract in all this region. It must always have been a chosen spot from the days of that Saxon Godhelm who gave his name to the fertile *Ing*, or meadow, by the River Wey, on which a town grew up.

The explanation of this fertility is that here the soil is largely formed from a deposit known as Bargate Stone. This is a hard and gritty sandstone, very calcareous, grey in colour, which rests upon a bed of pebbly sand. The flora is largely calcareous in type, and resembles that of the chalk. Godalming, with an abundant and varied vegetation, also possesses one or two flowers which grow there plentifully, and are said to be found nowhere else in Surrey. These are the Mountain Geranium, the Shining Geranium, the

Narrow-leaved Bitter Cress, and Starved Wood-sedge.

In Godalming the Hythe Beds reach their culminating point of fertility.

Opposed to the commons as regards the amount of moisture and elevation are the marsh-lands, with a totally different flora. A study of the distribution of marsh on the map shows very clearly that it lies on the low ground at the foot of the sandstone heights ; and it is caused by the water which has percolated through the sand, welling out where the impermeable stratum of the Atherfield Clay comes to the surface. The wedge-like form in which the Weald pushes into the Lower Greensand, south of Blackdown, is faithfully outlined by the flat, green marsh-land. Iping, Trotton, Milland, and Elmer Marshes are all due to the same cause, and all have a common likeness. Placed as they are at the foot of high ground, which rapidly falls from over 700 feet to under 200 feet, enclosed between two high ridges, from both of which the water soaks down, to be held by the clay, such marsh-land is inevitable. It is generally rich, green meadow-land, exceedingly damp, with frequent ponds, and springs issuing from the banks at the roadside. Where very swampy, the plants are of a grass-like character ; the water is highly calcareous ; and

where the vegetation is very dense, it gives rise to a peat which is rich in mineral substances, close in texture, and contains much plant food. Sedges are the predominant plants. Moss is also plentiful, but rarely *Sphagnum*, the true bog-moss of the moors.

But it is the boggy swamps which possess the greatest interest, and these occur on both the Hythe and the Folkestone Beds of the Lower Greensand. Standing as it does in close proximity to the common, sharing its rainfall and soil, bearing often the same forms of plants and trees—like it, often outside the reach of cultivation, the bog, with all this similarity, yet possesses features of the greatest difference.

It is characterized first and foremost by the constant presence of *Sphagnum* moss. This moss is truly of the moor, and wherever it grows it collects wetness. The spread of *Sphagnum* means the spread of wet surfaces. Formed by its peculiar structure to absorb moisture from the air, and growing on sites where rain falls plentifully, it often, by its extensive growth, leads to the formation of boggy land. It is dependent less upon the water in the soil than the water present in the air; but it must be in a position where it can retain the water it holds. So that, with a heavy rainfall and dew, a soil which is only slightly

permeable to water is also necessary. This is afforded by the peaty soil on which it grows, and to which it also adds.

The Bog-moss is associated with ericaceous plants, the various forms of heather, and whortleberry, and, generally speaking, with those of a xerophytic character. That the plants growing in it benefit in so far as they are xerophytes, is the result of the conditions to which they are exposed. The soil being physiologically dry to this kind of plant, which guards itself against too great an absorption of water, some such contrivance is necessary, since they are often exposed to strong winds, which dry the vegetation at a time when the activity of the root is checked by a cold soil.

Such boggy, Sphagnum-grown soil also contains free humous acids, which lower the activity of the plant's root, and make it difficult for it to replace the water lost by transpiration.

Many lovely, rare, and curious flowers are closely associated with the Bog-moss, and these are so entirely adapted to bog conditions that they are only found in such localities. Chief among these, as essentially bog-loving, and incapable of growth elsewhere, are the carnivorous plants—the long-leaved and round-leaved sundews, the catchfly, and the butterwort.

The peaty water of the bog contains few or no

bacteria, those agents of soil fertility. It is also poor in nutriment, especially nitrogen. Nitrogen, we know, is one of the essentials of plant life, and the plant must obtain it somehow; if not from the earth or the air, then from organic creatures which can furnish it—hence the fly-eating sundew.

The trees of the bog are those most adaptable of all plants, the Scots pine and the birch; whilst the ling grows into tall bushes, and the bell-heather becomes much more plentiful than in drier places.

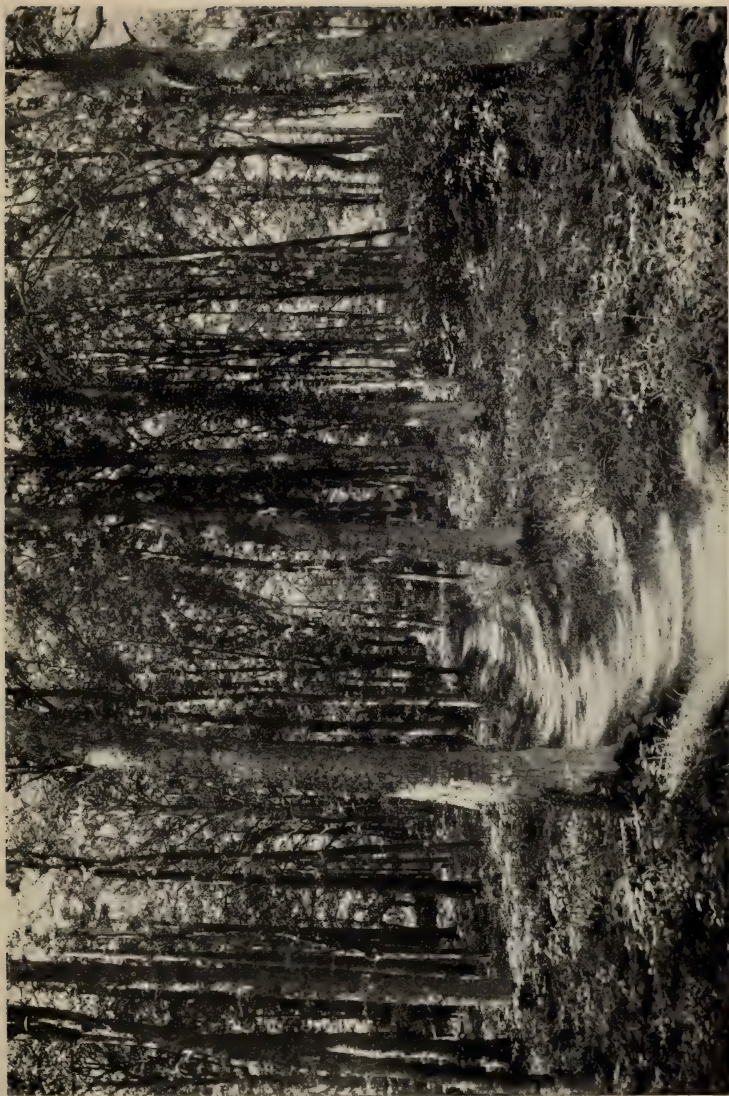
To study bog conditions and bog vegetation, one could not do better than to spend some hours at the bottom of the Devil's Punch Bowl.

The sides are covered with a deep and shaggy growth of fern and heather, mixed with gorse and broom. The middle slopes of the western side are thickly wooded. But the boggy character is most apparent in the upper end of the great valley—that part nearest to the Gibbet Hill ridge. Here, not only the bottom, but the sloping sides, form one morass. Everywhere is the light green of *Sphagnum* moss, with its tufted, cushiony growth, wettest and softest in the middle, where it rises highest. The water squeezes out from it as from a sponge. Growing frequently with it, also in tufts, but the tufts keeping a level surface

instead of the swelling form of the Bog-moss, and less spongy in its texture, is the dark green of the Hair-moss. Both of these mosses lose all their form and beauty when taken from the water wherein they live, and dried. The light green, feathery Bog-moss becomes faded and whitish-green—a shrunken, limp, and uninteresting plant; whilst the Hair-moss instantly folds its delicate, filamentous leaves upwards, and its star-like growth becomes merely so many dark green stalks. The bog plants require the setting of the bog.

Rising straight up from the soaking mosses, almost in the black pools of water, is the Bog Asphodel, golden in the summer, and standing golden-red in its slender fruit-laden stems in the autumn.

Wherever Bog-moss is, there the Sundew must be sought, and the search is certain. Both forms, the long-leaved and the round-leaved, live in the boggy ground, but the long-leaved Sundew seems to be associated rather with the moors of the Folkestone than those of the Hythe Beds. Not unlike it in general appearance and colouring, the Sundew may appear to be present to a careless glance, which mistakes for it a rosy-red patch of the young shoots of the Sphagnum, but a second glance will show that this lacks the spark-



Photo, West & Son, Gardnring.

Pine-Woods near Haslemere (p. 83).

ling little drops that should tip the tentacles of the rosette-like leaves.

Bog-rushes, with spreading brown panicles, grow up from the moss; marsh violets, quite distinct from the other varieties, grow in association with the Sphagnum, and the bog-bean.

Cotton-grass, with silky-white tufts, is a plant of the boggy swamps, found both in the wetter hollows of Blackdown and the larger, treacherous bog of Pudmere, on Thursley Common. The pink Bog Pimpernel and the Ivy-leaved Campanula belong to the plants of the Folkestone Beds, and near the ponds may be found the Sweet Flag and the Plantain Shoreweed.

Orchids also are found in our region, though not plentifully, except the Spotted Orchis and the Early Purple, both of which are abundant. The Twayblade and Lady's Tresses are not infrequent, and the Lesser Butterfly Orchid occurs, whilst in the copses the Bird's-nest Orchis may be found.

The foxglove is associated with woods, but with light woods, and whenever a copse is cleared the pink foxgloves spring up thickly.

The Scabious is a plant of the chalk, as well as of the Lower Greensand; but the large Meadow Scabious, that colours whole fields with its lavender-blue amongst the Downs, is seen here

rarely, if at all. It is represented by the little Sheep's Scabious, which is very abundant, and by the rounder, bluer, taller Devil's Bit Scabious.

Of the commoner wild-flowers, many are Labiates, Composites, and Umbellifers, which grow almost everywhere, without distinction of soil ; but the Pignut, an Umbellifer closely resembling Wild Chervil in its delicate misty white blossom, is said to be particularly a plant of the sand ; and though the Rosaceæ family is also widely spread, the Brambles are more largely represented in Surrey than in almost any other county.

Parasitic plants are by no means uncommon. The Dodder, which attacks the heather and gorse, with a curious appearance of tangled skeins of red cotton, has already been mentioned. But the Bird's-nest Orchis, with its intricate root, is a plant of the woods, parasitic upon hazel- and beech-trees ; and the thick Broom-rape, as its name denotes, is a parasite of the Broom.

To continue the list would merely be to catalogue the many flowers that belong to Surrey,* most of which are found in this particular region,

* A catalogue of the flowers for a large part of the region is given in "A List of the Flowering Plants and Ferns occurring within Six Miles of Haslemere," compiled by Rose Jackson, Haslemere Natural History Society, Science Paper No. 4.

but those mentioned above include most of those which possess a particular interest, either from the conditions under which they grow, their limitation of locality, or some variation of species.

But, deeply interesting as are the commons and the bogs, the thick woodlands which everywhere alternate with them are not less so. It would be difficult not to feel the charm and beauty of such woods as that through which a rough road leads between Hascombe and Hambledon—a wide area of scented pines, silent and lonely, the ground covered with moss, and ling, and whortleberry wherever the sunlight can steal through.

Or, again, in the pine-woods between Witley and Thursley, which end in common, brilliant with heather and gorse, where the trees, not closely crowded, stand on a carpet of moss, and the flowers grow between their stems. The roads are loose and sandy, mere cart-tracks cut through the forest, and innocent as yet of bicycle or motor-car. Every inch of ground holds possibilities of interest, and often yields something new and strange. Rabbits scuttle through the fern, and squirrels climb up the branches.

Except on the highest and most exposed points, or on the very poorest ground, as we have already seen, the commons themselves have their trees and plantations, and, looking east from the

highest ground, the eye roams over a sea of foliage that marks the oaks of the Weald.

In some districts it often happens that one kind of tree grows almost to the exclusion of others, or, at least, to such an extent that its present or former abundance is still marked in the very names of the villages. Oak, as we should expect, appears in many forms—Oakhanger, Oakshott, Oakwood. We also have Holly Hill and Holly Coombe. Fern growth is indicated in the names of Fernhurst and Ferncombe, both of which have as an alternative spelling Farnhurst and Farncombe; so that Farnham itself may have some such former meaning. Haslemere may be connected with the quantity of this tree, but of Nutcombe there is no doubt. The ash-tree is by no means common, yet we have a Cold Ash Vale.

One of the most interesting names with a local meaning occurs in the frequency of "hurt" as a fore-name. Thus we meet with Hurt Hill, Hurt Wood, Hurt Common. "Hurt" is the local name for the whortleberry, and Canon Capes explains it as being a corruption of "hart-berry," from the old English "heort-bere," a name given to the berry because deer browsed upon it.*

* "Rural Life in Hampshire," by Canon Capes.

Great as has been the drain upon the Wealden woodlands in times past, to furnish both wood for the navy and fuel for the manufacture of iron, they are still very extensive, as a study of the map shows. The forests of a region are an economic asset. Now that wood is used for so many purposes, and that the demand for it is continually on the increase, the amount and quality of the forest-land becomes of importance. It becomes necessary, not only to consider what has been done, but what it is possible still to do. The fitness or unfitness of the land for planting, and the kinds of trees which are most likely to prove of value, are questions to study on the spot. With its variety of soil, of aspect, and of elevation, its rainfall and prevailing winds, the conditions of shelter and exposure, all the intricate processes of forestry and its problems may well be encountered here.

Most of the woodland is copse, often very old, the remnants of those more extensive copses formerly used for timber. Though occasionally of mixed trees, they may consist of a single species. They contain tall-growing trees, such as oak, birch, ash, or chestnut; frequently sycamore or beech. Underneath is a thick growth, generally willow or osier willow, hazel, young oaks, or Spanish chestnut. These, too, may grow mixed,

but more often the whole undergrowth consists of one species only.

A distinction must be made between the terms "copse" and "coppice." The words are sometimes loosely used, as if they were interchangeable. "Coppice" comes from an old Saxon root which means "to fell." "Copse" is a shortened form of the same word. By "copse" is meant woods in which the forest trees are intermingled with the brushwood, which latter is cut down periodically, in periods varying from twelve to fifteen years. In coppices the timber is usually of a smaller description, and all the wood is felled or "coppiced," as in osier holts, at the same time.

It must be remembered that this county belongs to the Forest Belt. At the present time, however, Britain produces, in proportion to its area, less timber than most other countries of Europe. So that these copses, covering often very poor land, become of increased importance when woodland areas on good soil become more and more cleared for cultivation.

We have already seen that conifers grow better than any others on sand, and flourish on the poor soil. It is in their favour that they reach maturity and become marketable earlier than the oak or the beech, and yield heavier crops of timber. Wherever the gorse or broom grows

luxuriantly, there will be good crops of pines. The ling and bracken covered wastes are not so good, but, still, pines and firs find a roothold there.

The pine is the tree of the sandy common. The Scots Pine, like the ling, adapts itself with ease to different soils, and flourishes on dry, warm sand or in wet bog, only demanding a sufficiency of light. The Norway Spruce exactly reverses these conditions, as it bears dryness less well, and belongs to the class of trees which endure a high degree of shade.

From this it follows that the forms of vegetation accompanying these trees also differ. With the Scots Pine a xerophytic type of vegetation is the rule, because the poor, dry soil affords little moisture, or, in the case of bogs, the free humous acids present in the water make it difficult for plants to obtain moisture, and on these high, wind-swept moors the vegetation is more likely to be dried up. So that the pine, ling, heather, bracken, the birch and whortleberry, are closely associated. The Norway Spruce stands for the other extreme. Undergrowth is generally wanting. Such plants as may be found do not tend to xerophytic growth, owing to the dense shade, mosses being generally the prevalent form.

The question of undergrowth is so much also

a question of the amount of light that is able to fall through the branches of the forest trees, that it is possible to form a scale of degrees. Heading the light-loving trees is larch, under whose light and feathery foliage there is always abundant undergrowth. Then comes the birch, with slender, bending branches and thin, delicate leaves, hardly offering any obstruction to the light. In descending order, still avoiding shade, but contented with less sun, come the aspen, the alder, the Scots pine, the ash, the oak, and the sycamore. And then, with more crowded foliage and a denser growth, casting a heavy shade upon the soil beneath them, follow, still in strict order, the mountain pine, the Norway spruce, the beech, and the silver pine.

For this reason, the kind of tree which rules in the wood, will settle the question of the kind of flora that may be expected in it. The smaller plants must be of an adaptive character to suit themselves to the shade - enduring or light-requiring plants.

In this connection it may be interesting to learn that the most recent investigations in Botany upon this question tell us that the sensibility displayed by plants to light and shade (often very remarkable in everyday experience) points to the possession of some power of dis-

tinguishing these by means of sight organs. Very careful and patient observations and experiments, by means of powerful microscopes, reveal the fact that certain cells on the upper sides of the leaves of plants do actually contain lens-like bodies, similar in form and function to the lenses of the eye. Further experiments, we are told, have even succeeded in obtaining photographs of reflected images by means of these lenses.*

The most casual observer of trees will not fail to notice that, whilst some kinds are plentiful, others are entirely absent from certain districts, and that the trees are closely associated with the particular soil. This preference or compulsion often results in very sharp divisions, though, as we have seen in the cases of the birch and the Scots pine, there are a few trees which may be found in any locality, and are easily contented as to soil ; but in the majority of cases trees unfavourably placed drag on a poor, stunted, and struggling existence. It is also seen that, while certain trees live in harmony on the same soil, others enter into a deadly competition, in which one or the other is worsted.

Such are some of the fascinating problems of which woodland life and the study of forestry afford us glimpses.

* "The Eyes of Plants," *Nineteenth Century*, August, 1910.

The oak and the pine are the two trees most typical of the region, and stand at the two extremes—the oak as the tree of the clay, and the pine that of the sand. This is not to say that they are not both met with on the same ground, but each is fitted expressly for very opposite conditions. Mixed forest belongs to the more loamy districts, but with a greater or lesser uniformity of soil, the species are more or less uniform in character.

Beech, birch, holly, and chestnut, as well as firs and larches, are common upon the sandy and loamy soil. Less frequent are the sycamore and horse chestnut. Elms, poplars, and limes are altogether absent. Alders may be seen by the water in damp districts. By the Wey near Liphook they grow to a good size, and make fine trees. Also in damp places are the low-growing forms of willow, but one has to go as far as Farnham, or to the river-banks, to find willow-trees of any real size. The beech is not so much a tree of the sandy commons as the holly. The holly holds its own in solitary places, and attains a height and girth rarely seen on any other soil. Often scattered hollies and firs are the only upstanding trees among the stretches of heath and gorse upon the commons of the Hythe Beds. The Folkestone Beds show little forest growth in their higher

parts in comparison. Elsewhere, in thickets and as hedges, the holly alone is seen, rich and luxuriant in its growth. The holly, when it reaches this size and development, is of real economic value. Its hard wood commands a fair price in the market, and is used by cabinet-makers and to a certain extent in wood-carving. Its abundance here may be noted from the fact that it gives its name to special localities, where it forms the principal growth.

The beech, beautiful everywhere and at any time, the daintiest of trees in the spring and the most gorgeous in autumn, stands out among other trees by its strongly marked characteristics. Not so abundant on the commons in this region as the holly, it is still very frequent, and in the lanes more frequent still. Though the beech is particularly a tree of the chalk, and generally associated with it, as on the Chiltern Hills, it is said to reach its finest development in a sandy loam. Still, it is not restricted to or debarred from any soil, unless that soil contains an excess of lime.

Perhaps, as a tree, its greatest value is as a soil former and protector. Its leaves, though small and light in appearance, are extremely thickly and closely placed on the stem, and the density of the foliage on boughs which often sweep close to

the ground, casts so deep a shadow that no light-loving plant can grow under its shade. This deep shade and a thick carpet of the fallen leaves are the special features of beech-forest. The depth of this deposit is very great. A stick may be thrust into the leafy bed under a large beech-tree to the depth of 3 or 4 inches before it touches the soil. This close layer of dead and decaying foliage does not favour the growth of flowers, but fungi flourish upon it, and (with parasites) help to form a good soil. The humus resulting is of great value, since the leaves of the beech are exceptionally rich in potash.

Mosses or lichens, which grow everywhere in most forests, flourishing in the damp shade, rarely grow on a soil so thickly covered with leaves, but early in the spring, whilst ample sunlight still falls through the boughs of the beech-trees, flowers are often plentiful. But these cease later in the summer, when the thick foliage excludes the light. Thus, early in the year carpets of anemones, primroses, and hyacinths make the wood lovely, and everywhere are the bright green leaves of the wood-sorrel.

When growing on humous soil on the commons, the position of the beech is less permanent, and it is liable to disappear, and to be replaced by ling heath. This generally happens on windy hills.

The reason is that the leaf-covering of the soil and the soil itself are dried by the sun and wind, and become overgrown with grass and moss. Ling and whortleberries spread under such conditions, and ultimately the beech disappears. There are no beeches on the higher ground of Blackdown or Hindhead.

But where sheltered, where the slope insures good drainage, where the soil is light and sandy, even gravelly or stony, but not wet, there grows the sweet chestnut, making hanging woods on the sides of the hills. Those at Hascombe, clothing the steep slope of the southward-looking escarpment, are particularly fine. But the chestnut is very widely distributed over the sandstone. It is a tree that does not thrive on clay. To see it in perfection you must come to these poorer soils, to which it is as partial as the conifers. Not only is it to be found as a tall and imposing forest tree, but everywhere in the copses it forms a dense undergrowth, and is more cultivated in this form than any other tree.

The reason is that in poor soils it yields higher returns as coppice wood than any other form of growth. It is well suited to sandy or loamy tracts, and its thick fall of leaves furnishes good humus. Underneath oak it does very well. It is one form of forest industry that yields a reason-

able profit. The young trees are cut first at ten years of age, and are split up into short lengths for palings. At later intervals of fifteen years they are often cut as stout poles for hops. All odd wood is utilized by burning it into charcoal. The abundance of these copses, either close-set with the young trees, or cleared to the ground, with heaped stacks, shows how largely this work is carried on.

Hazel also is a popular growth for these copses, and almost as plentiful, and in the damper ground osiers are cultivated in the same way. Young oak is sometimes seen as coppice growth.

The conifers are particularly valuable, since they grow on the poor soil with vigour, and there are numerous plantations of Scots pine, larch, and Norway spruce, the three forms which are most found; and their tall, straight trunks make admirable long poles. As regards the price of these, when furnishing good timber, it is of interest to note that in most districts in Ireland larch fetches the highest price per cubic foot, varying from 6d. to 1s. Pine and spruce are of less value, the average price being only 3d. to 6d. per cubic foot.

The lovely lanes, their flowers and wonderful variety of mosses and fungi, and their over-arching trees, present special features of interest.

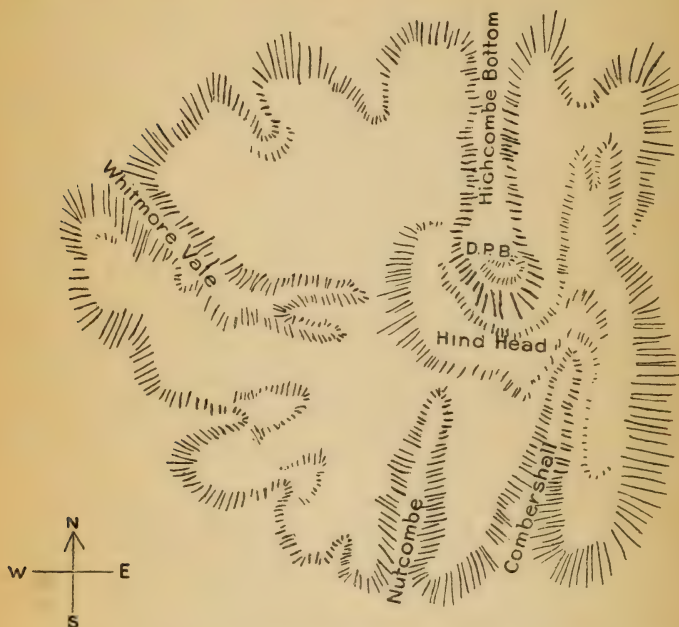
Leading, as they often do, from the lower ground right up to the highest points, the character of the vegetation is apt to vary. Oaks may be succeeded by beeches, and these give way to pines and birches. Holly-trees, too, are almost certain to be found. Such lanes, of great interest and beauty, are well represented by Tennyson's Lane, leading up to Blackdown from Haslemere, and Farnham Lane, leading to Hindhead.

Hedges are often absent, the rocky bank or piled stones taking their place, overtopped by trees, which stretch beyond on either side or slope downwards to a valley. The banks are green with many mosses, and with fine tufted grass, whilst the trees, particularly on their wet and windward sides, are draped with lichens of many kinds and colours.

The quick-set hedges of other more open country are not seen in these lanes. Strong hedges are formed by the process of pleaching, in which strong stems of young living trees are bent horizontally after having been partially cut through, and the living cross-bar thus formed sends out vertical shoots and stems. This process, frequently repeated, leads to the growth of a particularly massive form of hedge, in which the forest trees themselves make part.

Several times the colouring of the region has

been mentioned, and it is a point that cannot fail to draw attention, for colour is in itself often a distinctive feature in the physiognomy of the country-side. Here not only the vegetation but the soil itself contributes.



THE CHIEF VALLEYS IN HINDHEAD IN RELATION TO THE
DEVIL'S PUNCH BOWL.

Over the northern commons much of the scenery is of a sad quality, and a general dulness settles as the year advances. More cheerful, but somewhat uniform in its verdure, is the wooded country to the east. It is where the finer sandstones of the Hythe Beds rise, and the loamy



A Coppice of young Chestnut (p. 93).

soils neighbour them closely, that the greatest variety is seen. It is a thing to be counted.

The gold of gorse and broom, the rich hues of tussocky heather, colour whole hill-sides and spread all round. Against the blue of sky and green of common are the sombre purple of the thick-set firs and the lighter purple of ling. The larch, where it grows, lends a lighter green, and through all, a striking contrast, are the fiery tones of the sandstones, yellows deepening into orange and red. Here, in the centre of the region, in the lap of the rain, trees, rocks, and flowers reach their culminating point of interest.

BOOKS

"The Book of the Farm," by Henry Stephens; rewritten by James MacDonald.

"Flora of South-West Surrey," by S. T. Dunn.

"The Ecology of Plants," by E. Warming.

"Plant Geography," by F. W. Schimper.

"Plant Physiology and Ecology," by F. E. Clements.

"Research Methods in Ecology," by F. E. Clements.

"The Forester," by John Nesbit.

Report of Commission on Forestry, and Coast Erosion.

Leaflets of Department of Agriculture and Technical Instruction for Ireland :

1. Planting, Management, and Preservation of Shelter-belt and Hedgerow Timber.
2. Management of Plantations.
3. Felling and Selling Timber.
4. Cost of Forest Planting.

"Fungi and How to Find Them," by E. W. Swanton.

IV

The remote character of the region—The region as seen in a Domesday map—Roads on the sand, and roads on the clay—The Portsmouth Road—The Chichester Road—Communication by rail—The larger towns—The distribution of population—The growth of new towns—The rise of Haslemere—Picturesque villages—Disappearance of villages—The decay of industries—The growth of new industries—Across the region by rail—Across the region by motor-car.

THE structure of a region, the nature of its surface, the available water, and the possibilities the neighbourhood offers for agriculture or local industries, are questions which decide the growth of towns, and the lines of communication which connect them with each other. In dealing with South-West Surrey, we have to do with a district which for a long period was remote and isolated from the usual tracks, a region which has been very much left to itself until quite recently.

It is characterized by an absence of any large industry, by small, scattered villages, by very few large towns. It is the region of one great

road, that from London to Portsmouth, and of one great line of rail, the London and South-Western. Much of it is very picturesque and full of charm, the delight of the artist and lover of Nature, but with limited resources as a land investment for the agriculturist. On the farming-lands of the Weald the population shows a decided tendency to decrease. Larger villages and towns, however, are growing upon the higher, poorer ground, due still to geographical causes, but causes which are of extremely modern growth.

No better evidence of the change that has taken place can be given than that of the Domesday map of Surrey. The interest to us of the southwestern portion of that map lies in the very fact that it records so little. There is almost nothing to learn. Its boundaries are vague and undefined. The few towns marked lie, then as now, chiefly in the north, where the river winds towards the cleft in the chalk. It was a "no man's land," a land of wood and swamp, coveted by none, difficult to traverse, of no agricultural value, therefore unprofitable to hold. Its value came later, as a forested country, with the manufacture of iron, when its deposits of ironstone and its quantity of fuel were turned to account. No Roman road ran through this part of the country; no highways crossed its desolate com-

mons or skirted the frequent bogs. The land was largely waste.

From the nature of the ground, the greensand is more favourable to the construction of roads than the clay. Not only is it generally on a higher level, but the porous quality of the rock renders it easier for traffic. The ironstone, which is found so much in it, furnishes excellent road-metal, and the splendid condition of the Portsmouth Road is largely due to its use. Most of the great roads follow the strike of the rocks, and run mainly north-east and south-west. The more easterly portion was less favourable for the development of great main lines of traffic. The roads that crossed the clay were almost impassable for wheels in wet weather, when they were trampled into a stiff, tenacious mire, and deeply rutted. So difficult were these roads that a writer of the fifteenth century, remarking upon their undesirable qualities, can seriously wonder if the long legs of "cattle, women and other animals" in these parts may not be attributed to the strength of ankle required to pull the feet out of the clay mud, and that this might lead to a stretching of the muscle and a lengthening of bone.

The roads upon the sandstone generally keep to a fairly high level, wherever possible, to avoid

the frequent marshy or boggy ground. The Portsmouth Road ascends the highest of all, and goes right over the ridge of Hindhead, circling round the edge of the Punch Bowl. The road was formerly at a higher level at this point than it is at present, and the older portion of the road is still to be traced in a grassy track, which looks down upon the newer portion farther down the slope.

The road runs from north-east to south-west, in a very straight line, crossing a succession of almost continuous common and desolate moorland. It is remarkable for its well-metalled condition and its unceasing traffic, now very largely motor. Its general course is often parallel with the London and South-Western line, but always on a higher level. The road sends branches to Guildford and to Farnham—branches which are connected by a road that runs along the Hog's Back.

Perhaps the Portsmouth Road as a main route can best be compared with the Great North Road, which, however, it little resembles in natural features and the kind of country it crosses ; but both formerly bore the same character for lawlessness, and held the same terror for travellers. Wild and lonely, they were the haunt of highwaymen ; but no other could have equalled the Ports-

mouth Road in its exceeding desolation and loneliness. Even now it has not had the same influence upon settlement as the railway-line.

It goes from Guildford to Godalming, and, branching off at Milford, runs through Thursley, on through Bramshott and Liphook. The branch from Farnham, which meets it, runs almost due north and south. It lies far from a railway, and only crosses the military line which connects Farnham with Bordon and Longmoor Camps. It passes through the tiny hamlet of Greatham and the town of Liss, and joins the main branch. This is the military route between Woolmer Forest and Aldershot.

Branching off at Milford, a main road runs to Chichester which takes a southerly direction. This also diverges into two branches, one of which, starting from the north of Witley, runs parallel with the railway-line until it reaches Haslemere. Here it has a steep descent from Fernhurst to the Weald, of which it crosses a corner, but rises again to the sandstone on the south. The other branch strikes out across the clay, keeping, however, as far as possible on the higher levels, and runs southward through Chiddingfold, North Chapel, and Lurgashall, all small villages, and, except Chiddingfold, far from a railway-station. Ultimately this joins the other branch running

through Fernhurst. Like the Portsmouth Road, this is remarkable for its well-kept state, ironstone or Bargate stone being used for road-metal.

Communications gather thickly only in the neighbourhood of Guildford, Godalming, and Farnham, the three large towns of the region. Elsewhere good roads cross the greensand commons, and run through the pine-woods. On the clay between the small and distant villages roads are fewer. Many places are several miles from a railway-station, and even in those places through which the line passes the actual village is generally one or two miles distant. This is the case with Witley and Chiddingfold; and Milford, Liphook, and Liss all lie distant from the line that serves them.

The London and South-Western sends two diagonal branches across the region, communicating with each other only at Guildford and Farnham by means of an east to west line. East of Guildford another line runs on to Horsham, and the South-Eastern Railway just enters the region in a branch line on the north-east. In the extreme south-west the London and South-Western gives off a line which runs to Midhurst.

The line follows rather a wavering course. This is due to the configuration of the ground,

which makes it necessary, in order to avoid exceedingly steep gradients, to take advantage of the lower levels wherever possible. Even so the rise is very perceptible. After leaving Farncombe, Godalming, and Milford, the line directs its course for the niche in the hills where lies Haslemere. The dark mass of Hindhead, seen from this point, wears its most imposing aspect, and from Witley the panting of the engine bears witness to the steepness of the gradient, through some very lovely scenery. Leaving Haslemere, the line is on the down-grade to Liphook, and thence continues, till it leaves the region, through some of the prettiest scenery in Surrey.

The branch which runs through Farnham joins the main line northward at Woking, and southward bears upon Alton, in Hampshire. A line leaves it at Bentley which is for military use, and only serves the camps in Woolmer Forest.

Most of the villages communicate with each other only by road. A few small towns at distant intervals are strung upon the cross-line of rail, and so afford direct communication with London, and these show some signs of growth. The only large towns, Farnham, Guildford, and Godalming, are all river towns, and all placed at points of special advantage: Guildford in its gap, with the river, gathering up communications from each

direction ; Godalming where the river turns northward, in a valley of exceptional fertility ; and Farnham, in a depression, where the river turns southward, the centre of military communication.

These towns show a regular increase in population. But, setting aside Guildford, Farnham, and Godalming, only four towns exceed 2,000 inhabitants. These are Witley and Haslemere, both of which, on the main road from London, have benefited by the line ; Wonersh in the north-east, nearer the large towns ; and Frensham, remote in its commons. Shalford, also, between Guildford and Godalming, gains by its proximity to these towns.

Elsewhere few villages reach 1,000. Bramley, Seale, Shottermill, and Fernhurst are among those that do. Seale and Bramley probably owe their larger numbers to their more northerly position ; Shottermill certainly shares in the growing prosperity of Haslemere ; and Fernhurst shows a dwindling population, with a decrease of 150 in the ten years elapsing between census and census.

The census results of 1901, when compared with those for 1891, show that on the whole there is a growth of numbers in the villages of the western area, and a falling-off in those of the east. This in spite of the fact that the villages on the greensand are often small and remote. Exceptions

arise in both cases. The course of the railway is marked by larger villages. Liss boasts over 1,500 inhabitants, but Kingsley, Headley, Puttenham, and Thursley are all very small, and only in the last named exceed 500. Hambledon and Hascombe, though eastern in position, belong geographically to the sandstone area of the west, of which they are merely a prolongation, and whilst Hambledon, not far from the railway, has the larger population, Hascombe is dwindling.

Of the Wealden villages, belonging to the farming country, Chiddingfold stands easily first in point of numbers. Its population at the census of 1901 counted 1,548. All the other villages are small.

In some cases the actual gain of population cannot be said to indicate growth. Bramley, with an addition of three in ten years, is certainly not to be considered as increasing in numbers. The decrease is of a piece with the rest of the movement in which the small agricultural villages are becoming smaller and the towns larger. Growth is in every case along the line of the rail, or in the large towns which possess a natural advantage of position. But in the towns or villages which stand upon the high and bleak uplands, the growth is the more surprising, because those conditions which govern the choice of settlement are often absent or poorly represented.

They stand upon no large river ; a stream may or may not be near, or occasional springs, and water often has to be raised from a considerable depth. It is only within the last year that Haslemere has ceased to use wells, one of which was often shared by several houses. The want of suitable soil does not admit of adequate cultivation, and gardens are made at a price, so that the towns depend upon outside supplies. Of industries, with a few exceptions, there are none.

Haslemere is a very good example of a town thus placed. This, with Fernhurst and other of the ancient villages, dates back to a time when the iron industry was the main occupation, but their modern growth is chiefly due to causes which are not economic. The beauty of the surroundings, the purity of the air, the healthy and invigorating character of the Highlands, are the present inducements, and the railway gives access to them. It is still geographical forces which are at work, but they are of an æsthetic nature. Artistic, literary, and scientific considerations all have their share in the modern development of Haslemere, Witley, Chiddingfold, and Hambledon.

Most of the villages are exceedingly picturesque, and the modern spirit which is moving in these places tends to preserve this aspect. The native sandstone is largely used in building these dwellings

and cottages, and is a material in its soft shades and varying texture that lends itself well to effect. If not this, the bricks of the Atherfield Clay Works are largely employed, the colour of which is not to be surpassed, if matched, anywhere. A curious use is found here for the dark ironstone of the locality, which is also met with in other parts of Surrey; that is, to employ small bits to form a decoration, generally arranged in the mortar, so that it stands out in dark points. This is alluded to by Gilbert White in his "Selborne," where he speaks of the "ten-penny nails," as strangers termed them, in the cottage walls. No finer example could be met than in a cottage near Hambledon, in which the walls are studded from ground to roof in this way. It forms a very effective and simple form of natural decoration, and seems especially characteristic of West Surrey and Hampshire.

Nothing is more curious in the Domesday map, showing the villages then existent, than to see how, whilst some still retain the position of former times, others have quite disappeared from the map. Those of the south, we have seen, did not then exist at all. Such villages as there are seem all crowded into one corner, and radiate out from Guildford, along the lines of the river. This emphasizes the settlement of towns along the

river-banks, or in easy touch with communications. Guildford, Farnham, and Godalming were early settled, as such favourable points could not fail to be. The name of Guildford has even been said to be derived from a much-corrupted form of the same Keltic word which appears in Wey, another form of Wye; and thus the name of the town really meant "the ford of the Wey." This would point to an early British settlement.

Witley and Hambledon stand farthest south, the advanced guards facing the forest and the wild commons. But whilst Contone, Branlei, Piparherge, Gomeshall, all exist with a slight change of form, it is difficult to account for Redessolham, Hormera, Litelhoie, and Tetinges. They fall within the group of river towns, but their traces seem to have utterly vanished from the face of the map.

Not a single village exists in the Weald, where we imagine easily the thick forest growth the haunt of wolves. Thursley, Hascombe, and the other villages grew up later where good tracts of loamy soil promised reward for cultivation. Thursley, as a settlement, was probably included with Witley, to which it is a neighbour, for the name is ancient and points to Danish influences. In this part of Surrey, Saxon, Keltic, and Danish traces are curiously mingled. Thursley is a com-

pound of two. The prefix is said to be a corruption of the name of Thor, tacked on to a Saxon ending, and, it is thought, points to a peaceful settlement of Danes, perhaps during the time of Alfred. But of Roman influence there appears to be remarkably little.

Haslemere, in its high valley, for long held a solitary position. It occupies the one favourable position on the highest ground. All the other villages grew up on the lower slopes, and where tracts of good soil varied the poverty of the sand. Grayshott alone just surpasses Haslemere in elevation. But Grayshott as a village of any size is essentially of modern growth, and has become very much a representative of modern ideas. The older Grayshott was only a tiny hamlet, which bore the worst of reputations. It shared with Hindhead itself the character of lawlessness and wildness that belonged also to the Portsmouth Road, and made the locality to be regarded with disfavour by travellers.

It is well known that in this part of England the iron industry was at one time important. Even after the discovery of iron in the North, and the gradual change of economic conditions, iron-making still lingered in some of these villages. Fernhurst is said to be the last concerned in it, since the industry only died out in the middle of

the eighteenth century. It was generally more widely spread over the Sussex border than in Surrey. Curious traces are still to be found of its former activity in the names in various localities. " Hammer ponds " are frequent. We have also Hammer Bottom, Hammer Hill, and a village of Hammer. Furnace Field and Cinder Field both occur in the neighbourhood of Godalming ; Minepit Copse and Ironhill Common explain themselves.

Chiddingfold pursued a twofold industry, glass as well as iron. But all these trades have utterly disappeared. Chiddingfold firebacks remain as memorials which, when met with, are greatly valued. This village, still the largest of the Wealden villages, is one of the oldest in the county. Like most of these, its quaint old houses cluster round a village green, and the railway is two miles distant. Its age is in some measure indicated by its inn, one of the oldest existing, which is thought to have been originally a priest's house, and which, as an inn, dates back to 1536. It began to dwindle in importance when Queen Elizabeth suppressed the glass-making in response to local petitions, and later its iron-making followed.

With the shifting of the iron industry to the coal regions, and later on the gradual decrease of timber for the supply of the navy, local industries

fell very low. This region still hardly counts in the market, but it holds possibilities, some of which have already been noticed in passing. The cultivation of the sweet chestnut for palings is a home industry of growing value, and the larger stems, grown for poles, supply the neighbourhood of Farnham, the one point in the region where hops are extensively cultivated. And with this crop of small timber is associated charcoal-burning.

The other industries, also purely local, which cluster round Haslemere can hardly be said to result in the same way, from the development of natural resources. They rather take their origin from the same more modern influences which have led to the popularity of the town and district, and are interesting as being largely of the nature of experiment, though, perhaps, the actual experimental stage is safely past.

These industries are the outcome of an attempt to revive the artistic handicrafts, and have taken several forms. One of these is the weaving of textiles by hand, and the production of very beautiful work in cotton, wool, and silk. Beaten work in copper and other metals, a special form of pottery, cabinet-work, and embroidery and tapestry, are the different directions in which this industry finds outlets. The work shown is good and interesting. The works, which are not



Photo, West & Son, Gold Mining.

The Hog's Back (p. 101).

on a very large scale, lie in different directions just outside the town. In their nature they are artificial, not geographical, and their future remains to be seen. So far this development of artistic crafts appears to be confined to Haslemere, where it originated.

A more important, if less interesting, exception to the absence of any large local industry is to be found in the brickfields of the Atherfield Clay. These form extensive yards all round the narrow margin where this stratum crops out. The dull yellowish-brown clay burns into bricks of a very beautiful deep red, which, with the use of the local sandstone, adds so much to the warm colour of the villages. Both tiles and bricks are manufactured.

Bricks are also made from the clay of the Sandgate Beds. Near Liphook there are extensive works.

From what has been said of local industries, it follows that, with the exception of the Haslemere handicrafts, they represent, to some extent, the same two influences of sand and clay that are prevalent throughout the region, both in the actual soils that the timber-growing and the brick-making require and in the different typical positions in which each occurs—the chestnuts on the well-drained slopes, and the plastic clay in the valleys.

Whether we consider types of scenery, the origin of the springs and rivers, the flowers found by the roadsides or the thick forests which cover wide acres, the position and size of the villages, the direction and conditions of the main roads, the past and present conditions of labour, even the direction and amount of the rainfall, we see that all these differences are closely associated with the differences in rock and soil: the light and porous sandstone and the tough, impermeable clay. In this part of Surrey, by nature isolated and until late years remote, one of the best examples is given us of the working of simple geographical forces.

It is a region easily traversed, whether we go eastward from this side of Guildford, west beyond Crondall, or wander from the firs of Woolmer Forest to the farms of the Weald. From north to south, leaving Farnham, we touch Rogate, or from Guildford, the country that lies to the south of Plaistow and Kirdford. No single town or village in the whole region lies beyond the extent of a three or four hours' journey from London.

The region is entered by the gateway of the Wey gap. On each side the narrow wall of the chalk ridge stands like a barrier. Two ways lie open before us which will enable us to cross the

region from point to point. Whether we choose the line of rail south-westward from Guildford, or the swift path of the motor-car over the Portsmouth Road, our paths will converge on the south-western corner of the region.

The railway gives a comprehensive view of the region, as we rapidly pass over the different geological strata. Leaving the chalk and the alluvial valley of the Wey at Guildford, we cross the fertile valley of Godalming, with soil enriched by Bargate Stone. To our right lies the wide extent of the greensand commons, to the left we pass their extension in Hambledon and Hascombe, and cut through their narrowest width in nearing Witley. Now we enter the pine-woods, but beyond, on the left, lies the pasture country of the low clay levels. On the right, rising abruptly from the plain, Hindhead presents a bold front. And now the heights encompass us, as the train mounts heavily between Blackdown and its neighbour, and Haslemere is reached.

We have topped the utmost height of our path, and our line is downwards, quite on the greensand, to Liphook, but with a change of vegetation. Speeding across the coarser soil that lies beyond, we reach Liss, whence we should go north to Selborne. Still keeping to the south-

west, running through Hampshire to Portsmouth, we pass out of the region.

Or let us follow by car the Portsmouth Road. Guildford is still the gateway by which we enter our chosen land. We no longer seek carefully the narrow gaps and lowest levels. Rather we boldly attack the heights, and our road, as if by preference, mounts steadily until we are running over the ridge of the watershed, and behind us and beside an extensive tract of country lies open to our view. Our road, hard, white, well-kept, crosses commons all the way, but occasionally takes us through a wooded land. Few towns or villages break our path. Travelling swiftly, following in the wake of considerable traffic, we speed over Bognor Common, over the commons of Witley and Thursley. Our road mounts upwards to Gibbet Hill, and the wide valley of the Punch Bowl lies open before us. Small signs of fertility are to be seen. Around us are bare common and waving trees and sand, and gorse and ling brush our wheels. Sweeping round the very rim of the Punch Bowl, the road makes a great curve, white and dusty. We are over Hindhead, rushing through Grayshott, on the down-grade of Bramshott Common, in whose deep, secluded dells lie the hidden lakes of Waggoners' Wells. We speed through Liphook, low in its valley, across common

again, leaving the villages behind us, and so onwards following the same direction as the railway-line, south to Liss, and with the line we pass beyond our region, road and rail both converging on the same point, the coast and Portsmouth.

There is an old and a modern view of Hindhead and its surrounding country. But those of us who have studied this country in its every aspect, who have walked across its commons and through its lanes and woods, who have gone deep into its beautiful valleys, gathered flowers in its bogs, or felt the space and freedom of the heights, will be far from endorsing the views expressed by Cobbett, when he summed up this region by saying that much of it was "the most villainous spot of country God ever made."

BOOKS

"The Victoria History of Surrey."

"The Victoria History of Sussex."

"Rural Life in Hampshire," by Canon Capes.

"On the Distribution of Towns and Villages in England,"
by G. Chisholm : *Geographical Journal*, ix. 76, x. 511.

"Britain and the British Seas," by H. J. Mackinder.

"Old West Surrey," by Gertrude Jekyll.

The Census of England and Wales, 1901.

"Highways and Byways in Surrey," by Eric Parker.

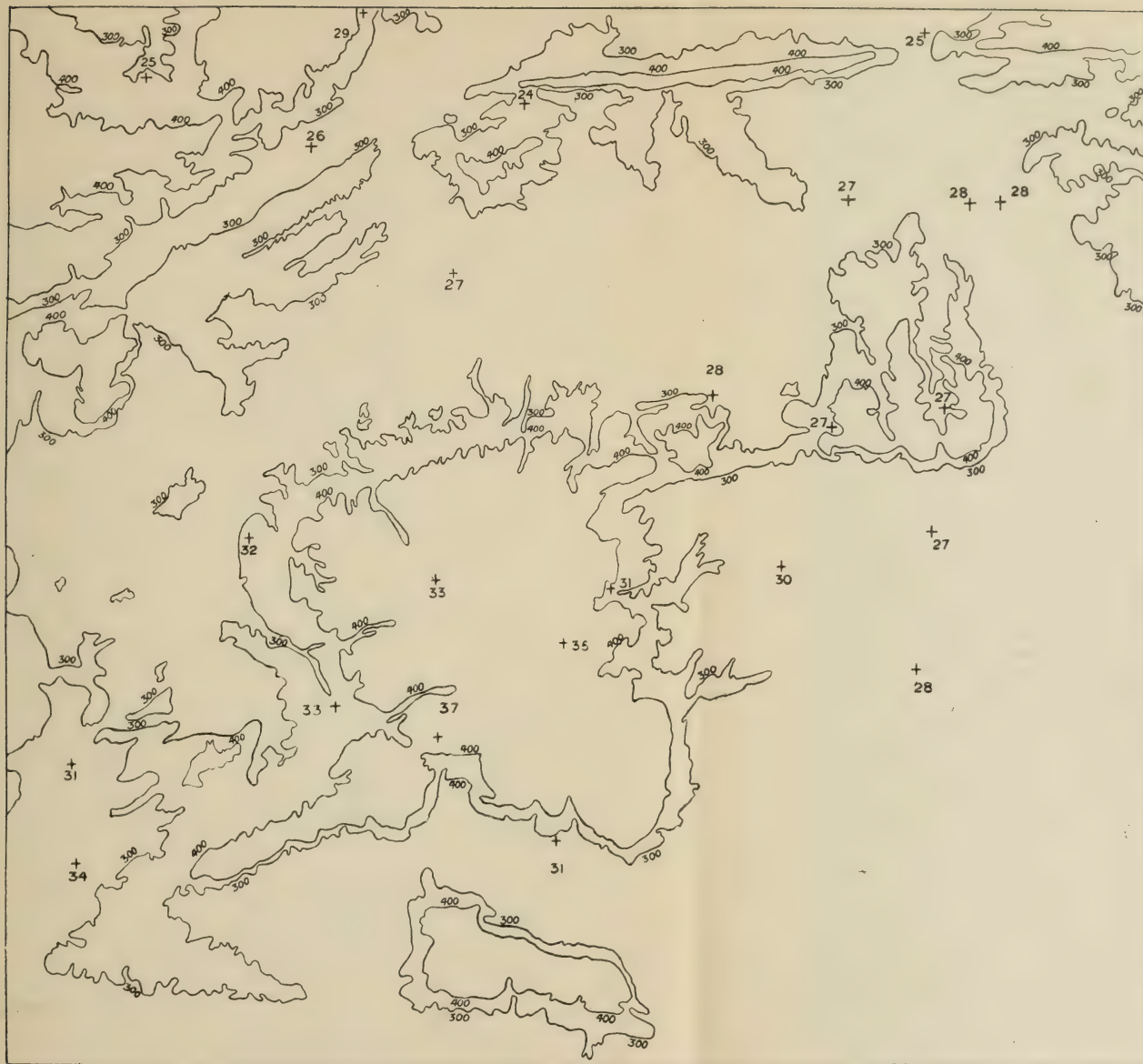
TABLE OF GEOLOGICAL STRATA

					{	Oldhaven or Blackheath Beds : pebbles and sand
<i>Eocene</i> ..	..	Lower London Tertiaries	..	..	{	Woolwich and Reading : clay, loam, and sand
					{	Thanet Beds : light-coloured sand
<i>Upper Cretaceous</i>		Upper and Middle Chalk	..	..		Soft chalks with flints
		Lower Chalk with Chalk marl	..			Chalk without flints
	{	Upper Greensand	..			Glaucinitic sand and marl
Selbornian		Gault	..	..		Stiff clay and sandy clay
	{	Folkestone Beds	..			Coarse sand and ferruginous concretions
		Sandgate Beds	..			Sand, sandstone, and fuller's earth
Lower Greensand		Hythe Beds	..	..		Sand, sandstone, ironstone, and chert
		Atherfield Clay	...			Clay and sandy clay
<i>Lower Cretaceous</i>		Weald Clay				

RAINFALL

SUMMARY OF RECORDS FROM 1897 TO 1906, GIVEN TO THE NEAREST INCH

Inches				Inches			
Seale .. ..	..	..	24	Grayswood Hill ..	..	..	31
Crondall .. ..	..	..	25	Weycombe .. ..	..	..	31
Guildford .. ..	..	..	25	Petworth .. ..	..	..	31
Farnham .. ..	..	..	26	Fernhurst .. ..	..	..	31
Dunsfold .. ..	..	..	27	Greatham .. ..	..	..	31
Hambledon .. ..	..	..	27	Liphook .. ..	..	..	33
Hascombe .. ..	..	..	27	Grayshott .. ..	..	..	33
Godalming .. ..	..	..	27	Liss .. ..	..	..	34
Witley .. ..	..	..	28	Bordon Camp .. ..	..	..	35
Wonersh .. ..	..	..	28	Haslemere .. ..	..	..	35
Bramley .. ..	..	..	28	Linchmere .. ..	..	..	37
Chiddingfold .. ..	..	..	30				



MAP TO ACCOMPANY RAINFALL STATISTICS IN "THE HIGHLANDS OF SOUTH-WEST SURREY" BY E. C. MATTHEWS (A. & C. BLACK)

BOTANICAL LISTS OF REPRESENTATIVE PLANTS

I. PLANTS CONFINED TO THE GREENSAND

H = Hythe Beds.

F = Folkestone Beds.

Upright Moenchia ..	<i>Cerastium quarternella</i>	Caryophyllaceæ
F Climbing Corydalis	<i>Corydalis claviculata</i>	"
F Knotted Pearlwort	<i>Sagina nodosa</i> ..	Fumariaceæ
F Petty Whin ..	<i>Genista anglica</i> ..	Leguminosæ
Subterranean Trefoil	<i>Trifolium subterraneum</i>	"
Hare's-foot Trefoil	<i>Trifolium arvense</i> ..	"
Bird's-foot Trefoil	<i>Ornithopus perpusillus</i>	"
F Soft-knotted Trefoil	<i>Trifolium striatum</i> ..	"
F Hoary Cinquefoil ..	<i>Potentilla argentea</i> ..	Rosaceæ
Least Cudweed ..	<i>Filago minima</i> ..	Compositæ
Mt. Groundsel ..	<i>Senecio sylvaticus</i> ..	"
H Wall Hawkweed ..	<i>Hieracium murorum</i>	"
H Wood Hawkweed	<i>Hieracium vulgatum</i>	"
Narrow-leaved Hawkweed	<i>Hieracium umbellatum</i>	"
Dwarf Nipplewort	<i>Arnoseris fusilla</i> ..	"
Common Sawwort	<i>Serratula tinctoria</i> ..	"
Whortleberry ..	<i>Vaccinium myrtillus</i>	Ericaceæ
Dwarf Silky Willow	<i>Salix repens</i> ..	Salicineæ
H Pale Smooth-leaved Willow-herb ..	<i>Epilobium roseum</i> ..	Onagraceæ
H Lamb's Lettuce ..	<i>Valerianella olitoria</i>	Valerianaceæ
H Small Teazel ..	<i>Dipsacus pilosus</i> ..	Dipsaceæ
H Early Field Scorpion Grass ..	<i>Myosotis collina</i> ..	Boraginæ
H Yellow Cow-wheat	<i>Melampyrum pratense</i>	Scrophulariaceæ
F Ciliated Pearlwort	<i>Sagina ciliata</i> ..	Caryophyllaceæ
F White Meadow Saxifrage ..	<i>Saxifraga granulata</i>	Saxifragaceæ
Northern Hard Fern	<i>Tomaria spicant</i> ..	Filices
H Black-stalked Spleenwort	<i>Asplenium adiantum nigrum</i>	"
H Narrow-leaved Prickly-toothed Shield Fern ..	<i>Lastræa spinulosa</i> ..	"
H Sweet Mt. Fern ..	<i>Lastræa oreopteris</i> ..	"

II. PLANTS FREQUENT ON CHALK OR SAND ; ABSENT FROM CLAY

Common Milkwort	<i>Polygala vulgaris</i>	..	Polygalaceæ
Long-stalked Geranium	<i>Geranium columbium</i>		Geraniaceæ
Rose-bay Willow-herb	<i>Epilobium angustifolium</i>		Onagraceæ
Carlina Thistle ..	<i>Carlina vulgaris</i>	..	Compositæ
Ivy-leaved Lettuce	<i>Lactuca murale</i>	..	„
Nettle-leaved Bell-flower	<i>Campanula trachelium</i>		Campanulaceæ
Viper's Bugloss ..	<i>Echium vulgare</i>	..	Boraginæ
Devil's Bit Scabious	<i>Scabiosa succix</i>	..	Dipsaceæ
Field Scabious ..	<i>Knautia arvensis</i>	..	„
Sheep's Scabious ..	<i>Jasione montana</i>	..	Campanulaceæ

III. ALMOST CONFINED TO WEALD CLAY

Bulbiferous Coralwort	<i>Dentaria bulbifera</i>	..	Cruciferae
Mt. Speedwell ..	<i>Veronica montana</i>	..	Scrophulariaceæ
Awned Nit Grass ..	<i>Gastrichium tendigerum</i>		Gramineæ
Daffodil	<i>Narcissus pseudo-narcissus</i>		Amaryllidæ

IV. FOUND ONLY NEAR GODALMING

Mt. Geranium ..	<i>Geranium pyrenaicum</i>		Geraniaceæ
Shining Geranium ..	<i>Geranium lucidum</i>	..	„
Narrow-leaved Bitter Cress	<i>Cardamine impatiens</i>		Cruciferae
Starved Wood-sedge	<i>Carex depauperata</i>	..	Cyperaceæ

V. BOG AND MARSH PLANTS

F Marsh St. John's Wort	<i>Hypericum elodes</i>	..	Hypericinaceæ
F Purple Marsh Cinquefoil	<i>Potentilla comarum</i>	..	Rosaceæ
F Long-leaved Sundew	<i>Drosera intermedia</i>	..	Droseraceæ
Round-leaved Sundew	<i>Drosera rotundifolia</i>	..	„
F Bog Pimpernel ..	<i>Anagallis tenella</i>	..	Primulaceæ

Bog Asphodel ..	<i>Narthecium ossifragum</i>	Liliaceæ
H Water Speedwell ..	<i>Veronica anagallis</i> ..	Scrophulariaceæ
Bog Violet	<i>Viola palustris</i> ..	Violaceæ
Bog Moss	<i>Sphagnum</i>	Musci
Hair Moss	<i>Polytrichum commune</i>	„
F Marsh Club Moss ..	<i>Lycopodium inundatum</i>	Lycopodiaceæ
Cotton-grass ..	<i>Eriophorum vaginatum</i>	Cyperaceæ
F Heath-rush ..	<i>Juncus squarrosus</i> ..	Juncaceæ
F Lesser-jointed Bog-rush	<i>Juncus supinus</i> ..	„
Bog Bean	<i>Menyanthes trifoliata</i>	Gentianaceæ

VI. PARASITES

Lesser Dodder (parasitic on heather)	<i>Cucurbitaria epithymum</i>	Convolvulaceæ
Greater Broom-rape (parasitic on Broom)	<i>Orobancha major</i> ..	Orobanchaceæ
Bird's-nest Orchis (parasitic on Beech- and Hazel-root)	<i>Neothia nidus-avis</i> ..	Orchidaceæ

VII. TREES

Sand or sandy loam	{	The Scots Pine	<i>Pinus sylvestris</i>	..	Coniferæ
		Norway Spruce	<i>Abies excelsa</i>	..	„
		Larch	<i>Abies larix</i>	..	„
		Holly	<i>Ilex aquifolium</i>	..	Aquifoliaceæ
		Spanish Chest-nut	<i>Castanea vulgaris</i>	..	Cupuliferæ
		Beech	<i>Fagus sylvatica</i>	..	„
		Oak	<i>Quercus robur</i>	..	„
		Birch	<i>Betula alba</i> ..	..	Betulaceæ
		Hazel	<i>Corylus avellana</i>	..	Cupuliferæ
		Sycamore ..	<i>Acer pseudo-platanus</i>		Aceraceæ

This list does not include flowers of more general distribution or less exclusive habit, which are found in woods, meadows, or hedgerows, without distinction of soil. It comprises plants which are either characteristic of the soils in question, or which show a large development in this particular region.

CENSUS RETURNS

		1901	1891
Hampshire	Binstead ..	1,272	1,331
	Bramshott ..	1,740	1,683
	Crondall ..	1,505	1,321
	Kingsley ..	352	399
	Liss ..	1,701	1,538
	Greatham ..	533	288
Surrey	Alfold ..	517	540
	Bramley ..	1,915	1,912
	Chiddingfold ..	1,548	1,515
	Compton ..	570	558
	Dunsfold ..	623	586
	Elstead ..	904	775
	Farnham ..	6,124	5,545
	Frensham ..	2,103	
	Godalming ..	8,748	8,117
	Guildford ..	8,413	7,348
	Hambledon ..	707	675
	Hascombe ..	415	426
	Haslemere ..	2,614	1,784
	Headley ..	394	415
	Peperharow ..	175	159
	Puttenham ..	457	441
	Seale ..	1,061	1,029
	Shalford ..	2,082	1,820
	Shottermill ..	1,619	947
	Thursley ..	672	614
	Witley ..	3,549	3,107
	Wonersh ..	2,021	2,068
Sussex	Fernhurst ..	1,076	1,133
	Lurgashall ..	701	762
	North Chapel ..	782	742
	Rogate ..	940	964
	Trotton ..	434	451

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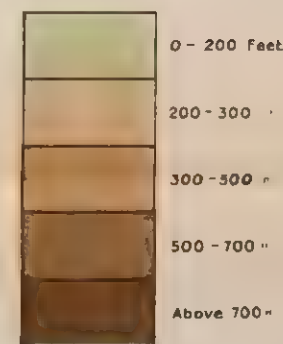
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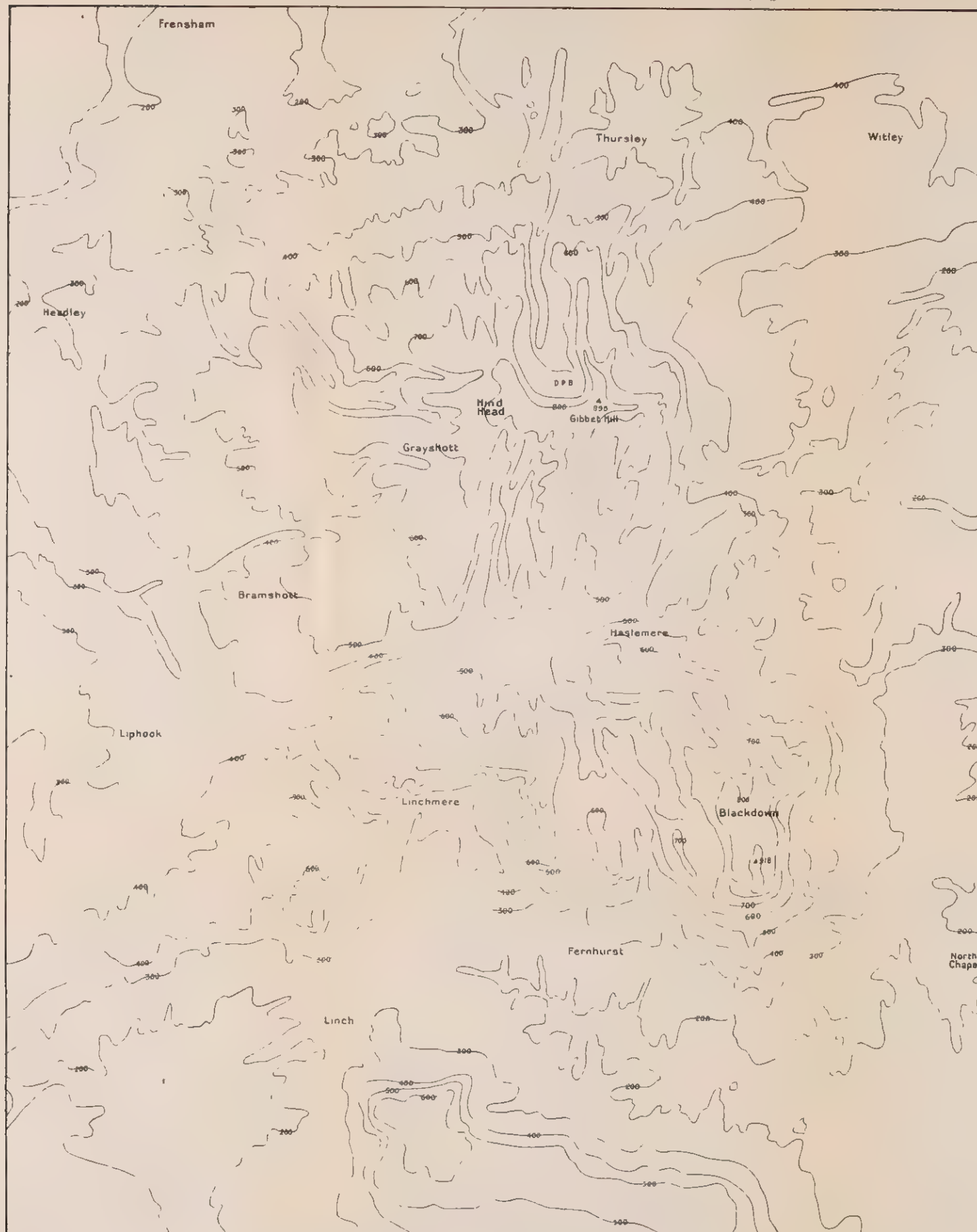
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